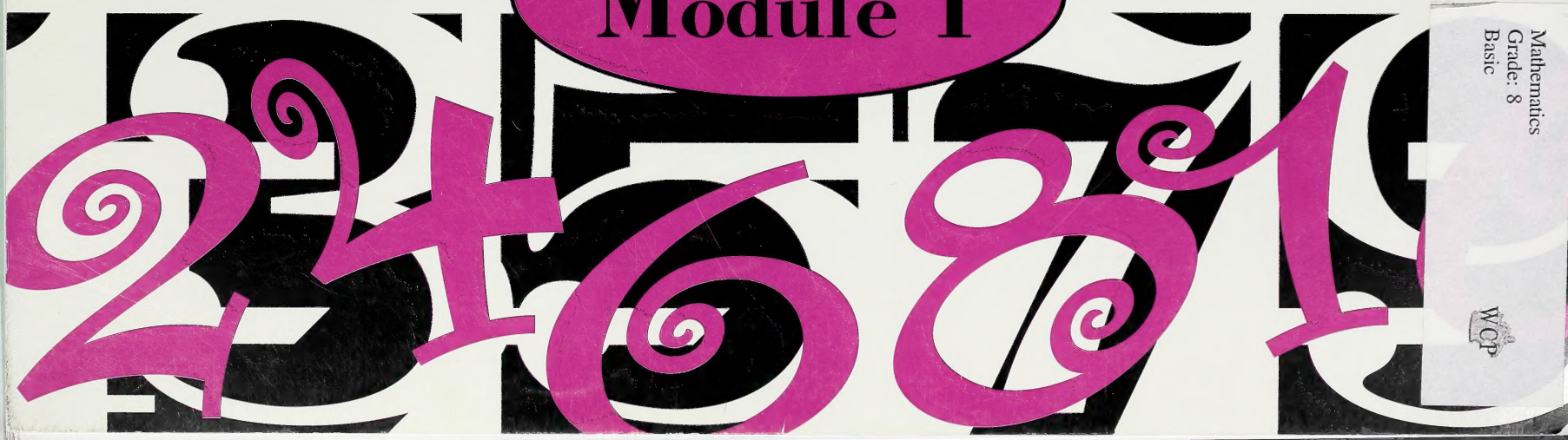
MATHEMATICS 8

Number Connections

Distance Learning

Alberta EDUCATION

Module 1



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Module 1

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Mathematics 8
Student Module Booklet
Module 1
Number Connections
Learning Technologies Branch
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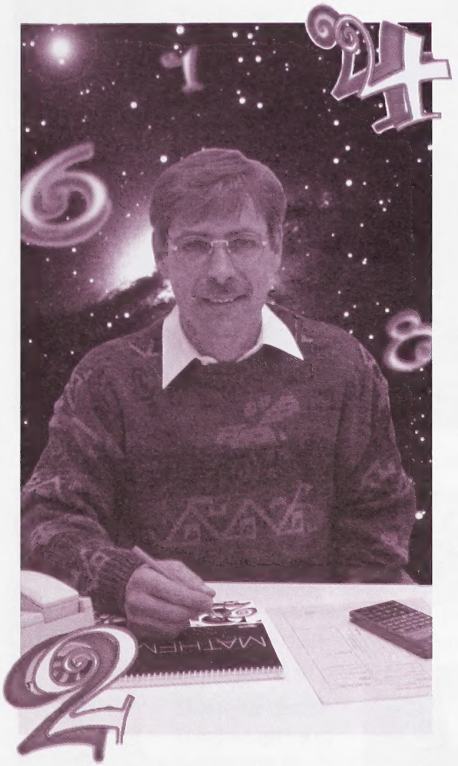
This document is intended for	
Students	✓
Teachers	✓
Administrators	
Parents	
General Public	
Other	

The Learning Technologies Branch has an Internet site that you may find useful. The address is as follows:

http://ednet.edc.gov.ab.ca/ltb

The use of the Internet is optional. Exploring the electronic information superhighway can be educational and entertaining. However, be aware that these computer networks are not censored. Students may unintentionally or purposely find articles on the Internet that may be offensive or inappropriate. As well, the sources of information are not always cited and the content may not be accurate. Therefore, students may wish to confirm facts with a second source.

Welcome



Welcome to Module 1. We hope you'll enjoy your study of Number Connections.

Mathematics 8 contains six modules. Work through the modules in the order given, since several concepts build on each other as you progress in the course.

Mathematics 8

The document you are presently reading is called a Student Module Booklet. You may find visual cues or icons throughout it. Read the following explanations to discover what each icon prompts you to do.

- Prepare for a problem that will provide a change of topic.

- Prepare for a challenging problem related to the topic of the activity.

- Use the Internet to explore a topic.

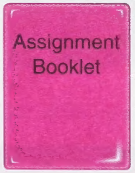
- Use computer software.

- Use a scientific calculator.

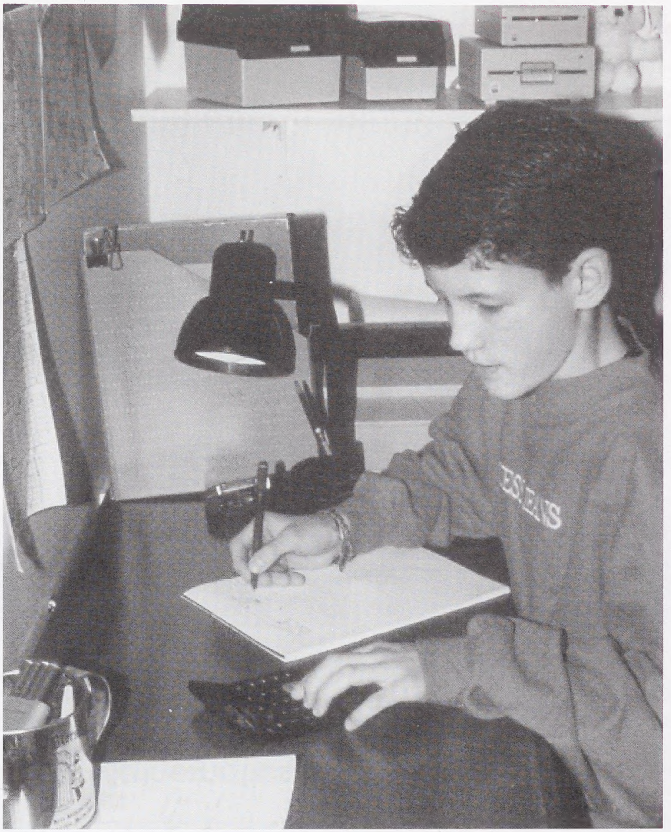
- View a videocassette.

- Pay close attention to important words or ideas.

- Use the suggested answers in the Appendix to correct activities.



- Answer the questions in the Assignment Booklet.



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There are no response spaces provided in this Student Module Booklet. This means that you will need to use your own paper for your responses. You should keep your response pages in a binder so that you can refer to them when you are reviewing or studying.

Technology

Today society is turning to **technology** more than ever before, and it is to your advantage to be able to effectively use technology when required.

Technology is the application of tools, materials, and processes to the solution of problems. More specifically, technology refers to devices and systems that are used in processing, transferring, storing, and communicating information through electronic media.

In Mathematics 8, along with the course materials, you will use a calculator, computer, and videocassette player as tools for learning and doing mathematics.

Calculators are helpful tools for solving problems and exploring patterns and relationships between numbers. Using a calculator will also save you time and help you develop your estimating skills. Therefore, you will be given numerous opportunities in each module to use a calculator.

Computers are useful for organizing and displaying data, or drawing figures. For this reason you will have the chance in many activities to work with popular computer applications such as spreadsheets and draw programs. You will also want to check out the many Internet connections in each module.

Videocassette players allow you to view video programs on key concepts that are difficult to explain in print. That is why video programs are cited in this course.

It is expected that all of you will be able to view the video programs and use a calculator, and that most of you will do the computer activities. However, if you are unable to access a computer, you may do the calculations using a calculator, and draw figures and graphs by hand.

Problem-Solving Skills

One of the exciting features of this course is that you will develop and improve your ability in problem solving. You will need these problem-solving skills many times in your lifetime. Since this course focuses on problem solving, it is important that you understand what a **problem** is.

A problem is a task for which the method of finding the answer (as well as the answer) is not immediately known.

Like any skill, the skill of problem solving must be developed. Problems may or may not involve computation (adding, subtracting, multiplying, and dividing). Some problems are realistic; others are puzzles.

You will have the opportunity in most activities to try a problem-solving challenge. Watch for these icons.

This icon is a cue that the problem will be related to the topic of the activity.

This icon is a cue that the problem will provide a change of topic.

The Four-Stage Process

There are four stages that can be used to solve any problem: understanding the problem, developing a plan, trying the plan, and looking back.

Understanding the Problem

In this stage you should expect to feel puzzled. There are various reasons for feeling this way.

- You may not know the meanings of all the words.
- You may not understand the situation in the problem.
- You may be confused by unnecessary information.

Once you understand the problem, you should think about the problem and make an estimate of what the answer should be. This will help you arrive at a reasonable answer.

Developing a Plan

This is where you should decide on the plan of action that you are going to take to solve the problem. You may consider the following strategies:

- using objects
- using diagrams
- making a table
- working backwards
- using elimination
- using truth tables
- using an equation
- changing your point of view
- making an organized list
- using Venn diagrams
- simplifying a problem
- guessing, checking, and revising
- finding and applying a pattern
- acting out a problem

Note: The Appendix in Module 6 explains these strategies in detail. When you see a problem-solving icon in any module, you should turn to the Module 6 Appendix and review the problem-solving strategies.

Trying the Plan

In this stage you should try the plan and see if it works.

Be sure to work carefully and record your progress. You are encouraged to use a calculator to help with your calculations.

Note: While trying the plan, you should monitor your progress in order to determine if your plan will lead to a solution. You may find that the plan will not produce a solution, in which case a new plan will have to be developed.

Looking Back

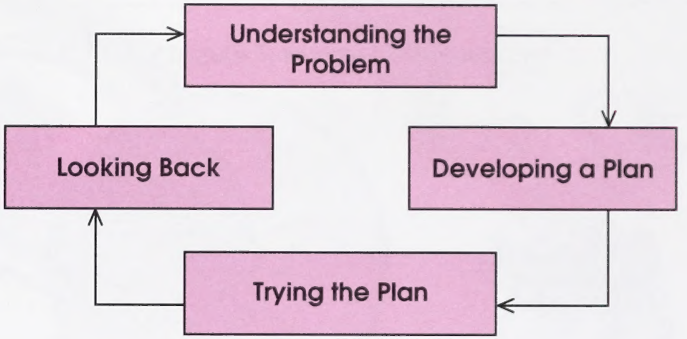
In this stage you should look back at the problem and compare your answer to the estimate you made in the first stage. Restate the problem using your answer.

Ask yourself these questions: "Did my plan work? Is my answer reasonable?"

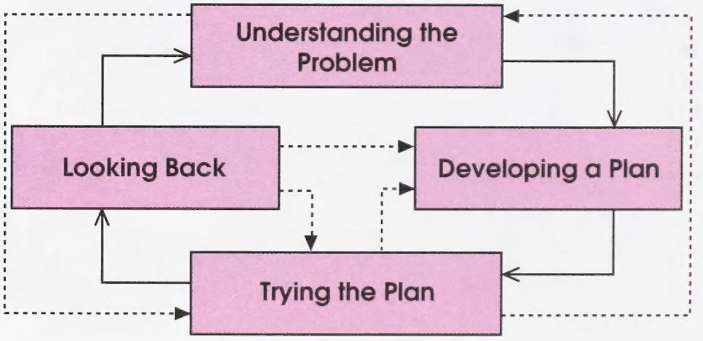
If you did not arrive at an answer, another strategy may work better. If your answer is unreasonable, you may have made errors while trying your plan.

Sequence of Stages

You usually approach a problem in the order outlined in the following diagram.



If you encounter difficulties in your original plan, or if you realize that another strategy will have better results, you may need to return to an earlier stage or use the stages in a different sequence.



CONTENTS

Module Overview

Have you ever gazed at the Moon and wondered what your life would be like if you lived on the lunar surface? It would be a very strange life since conditions on the Moon are very different from conditions on Earth. The Moon's mass is $\frac{1}{8}$ of the Earth's mass and its diameter is about $\frac{1}{4}$ of Earth's. These factors combine to give the Moon a surface gravity of only $\frac{1}{6}$ of Earth's. This means you would be able to hop much farther on the Moon than on Earth. That could be quite exciting. However, you might not like the temperature extremes. The temperature on the Moon can reach $+134°C$ during periods of sunlight and plunge to $-170°C$ at night.

To appreciate the conditions on the Moon, you must have number sense. What do the fractions $\frac{1}{8}$, $\frac{1}{4}$, and $\frac{1}{6}$ mean? What do the positive and negative numbers of $+134°C$ and $-170°C$ mean?

In this module you will increase your number sense. You will perform operations on fractions and mixed numbers. You will work with positive and negative numbers. You will also discover how numbers are connected to the everyday world.

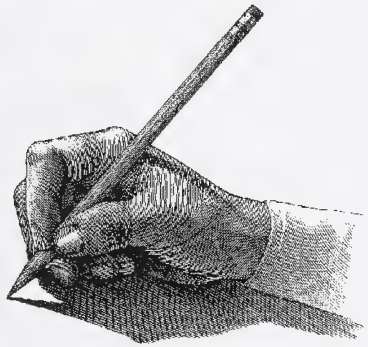
Module 1: Number Connections

Evaluation

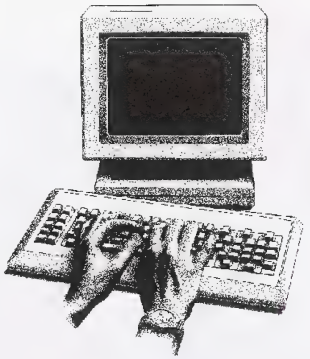
Your mark for this module will be determined by how well you complete the assignments at the end of each section and at the end of the module. In this module you must complete three assignments. The mark distribution is as follows:

Section 1 Assignment	**42 marks**
Section 2 Assignment	**26 marks**
Final Module Assignment	**32 marks**
TOTAL	**100 marks**

When doing the assignments, work slowly and carefully. You must do each assignment independently, but if you are having difficulties, you may review the appropriate section in this module booklet.



If you are working on a computer managed learning (CML) terminal, you will have a module test as well as a module assignment.



Note

There is a final supervised test at the end of this course. Your mark for the course will be determined by how well you do on the module assignments and the supervised final test.

Section 1: Fractions and Mixed Numbers

Do you enjoy taking photographs? Have you ever used a 35-mm camera? Some 35-mm cameras have automatic settings; however, many photographers prefer to use cameras in which they select options such as shutter speed.

The shutter speed controls the amount of light allowed to enter the camera. The numbers 2, 4, 8, 15, 30, 60, 125, 250, and 500 on a camera dial are shutter speeds and represent the fractions $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{15}$, …, $\frac{1}{500}$ (of a second). For example, if the photographer sets the opening at 60, the shutter stays open for $\frac{1}{60}$ s. Fractions and mixed numbers are frequently used in the everyday world.

In this section you will perform operations on fractions and mixed numbers. You will use models and pictures to help you visualize the operations. You will use paper-and-pencil methods, mental computation, and calculators to find the sums, differences, products, and quotients.

Activity 1: Adding

Franscesca enjoys her part-time job at the greenhouse. On Monday she worked $1\frac{3}{4}$ h. On Tuesday she worked $2\frac{3}{4}$ h. Altogether, how much time did Franscesca work in the greenhouse on these two days?

By the time you finish this activity, you will be able to solve problems like this.

Adding Fractions

To begin your investigation of the addition of fractions, you will work with pattern blocks.

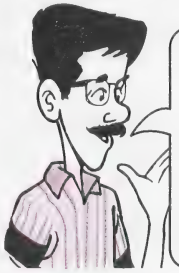
Find the cut-out pattern blocks in the Appendix of this module. Photocopy the pages of learning aids. You may wish to colour these learning aids. Laminate these pages (or glue them to heavier paper) before cutting them out. Your school may have wooden or plastic pattern blocks which you could also use.

Gather your pattern blocks and the video program *Adding and Subtracting Fractions* from the series *Math Moves*.

1. View the segments on adding fractions and do the video assignments.

Check your answers by viewing the video program.

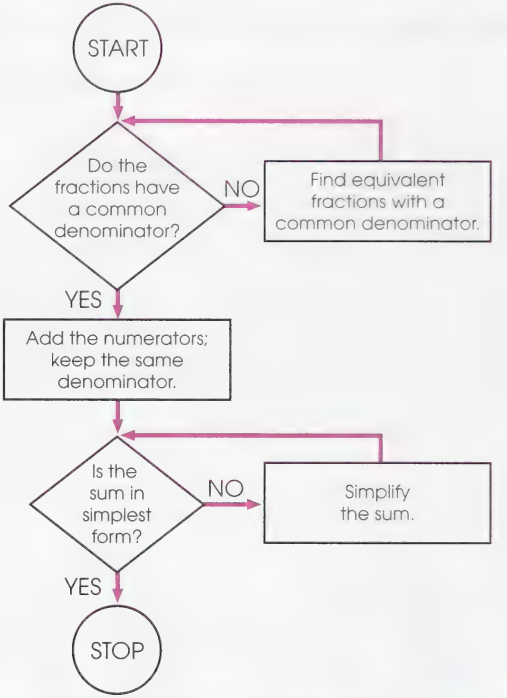
Note: Do not rewind the videocassette as you will continue to view the program in the next activity. Also, save the pattern blocks as you will need them again.



You can use the patterns you discovered to develop an **algorithm** for adding two fractions.

An algorithm is a set of steps for finding the answer to a problem.

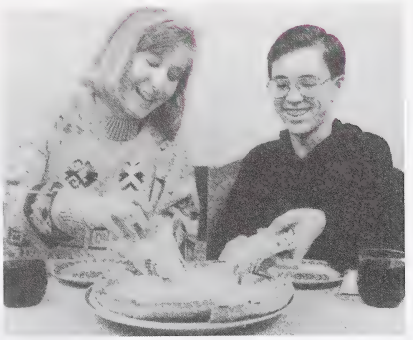
The algorithm for adding two fractions is given in the following flow chart.



Notice how the algorithm is used in the following examples. Also notice how fractions may be added horizontally or vertically.

Example 1

Jack and Jill shared a pizza. Jack ate $\frac{3}{8}$ of the pizza and Jill ate $\frac{1}{8}$ of the pizza. What fraction of the entire pizza was eaten by Jack and Jill together?



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Solution

Method 1: Adding Horizontally

The fractions have a common denominator.

$$\frac{3}{8}+\frac{1}{8}=\frac{3+1}{8}$$ ← Add the numerators; keep the common denominator.

$$=\frac{4}{8}$$ ← Simplify the sum.

$$=\frac{1}{2}$$

Together, Jack and Jill ate $\frac{1}{2}$ of the entire pizza.

Method 2: Adding Vertically

$$\begin{array}{r} \frac{3}{8} \\ +\ \frac{1}{8} \\ \hline \frac{3+1}{8}=\frac{4}{8}=\frac{1}{2} \end{array}$$

Together, Jack and Jill ate $\frac{1}{2}$ of the entire pizza.

Note: Pictures may help you visualize the situation.

This diagram shows Jack's share of the pizza. He ate 3 eighths.

This diagram shows Jill's share of the pizza. She ate 1 eighth.

The following diagram shows the fraction of the pizza eaten by Jack and Jill together.

3 eighths + 1 eighth = 4 eighths
= 1 half

=

Together, Jack and Jill ate $\frac{1}{2}$ of a pizza.

Example 2

Rachel likes to write stories. On Tuesday she wrote for $\frac{1}{2}$ h. On Thursday she wrote for $\frac{3}{4}$ h. Altogether, how much time did Rachel spend writing?

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Solution

Method 1: Adding Horizontally

The fractions do not have a common denominator.

$$\frac{1}{2}+\frac{3}{4}=\frac{2}{4}+\frac{3}{4}$$ ← Find equivalent fractions with a common denominator.

$$=\frac{2+3}{4}$$ ← Add the numerators; keep the common denominator.

$$=\frac{5}{4}$$ ← Simplify the sum.

$$=1\frac{1}{4}$$

Altogether, Rachel spent $1\frac{1}{4}$ h writing.

Method 2: Adding Vertically

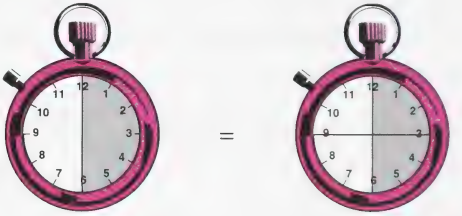
$$\begin{array}{r} \frac{1}{2} \\ +\ \frac{3}{4} \\ \hline \end{array} = \begin{array}{r} \frac{2}{4} \\ +\ \frac{3}{4} \\ \hline \end{array}$$

$$\frac{2+3}{4}=\frac{5}{4}=1\frac{1}{4}$$

Altogether, Rachel spent $1\frac{1}{4}$ h writing.

Note: Pictures may help you visualize the situation.

This diagram shows the time Rachel spent writing on Tuesday. Rachel wrote for $\frac{1}{2}$ h, or $\frac{2}{4}$ h.



This diagram shows the time Rachel spent writing on Thursday. She wrote for $\frac{3}{4}$ h.

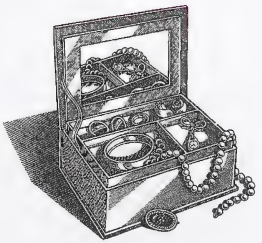
The following diagram shows the total time Rachel spent writing.

2 fourths + 3 fourths = 5 fourths
= 1 and 1 fourth

Altogether, Rachel spent $1\frac{1}{4}$ h writing.

Use a paper-and-pencil method to answer questions 2 to 5.

2. Melody had a jewellery collection that she wanted to share with her sisters. She decided to give $\frac{3}{10}$ of the collection to Judy and $\frac{5}{10}$ of the collection to June. What fraction of her jewellery collection did Melody give away?



3. On Friday Mark spent $\frac{3}{8}$ of the day sleeping and $\frac{1}{4}$ of the day doing school work. What fraction of the day did Mark spend on these two activities?

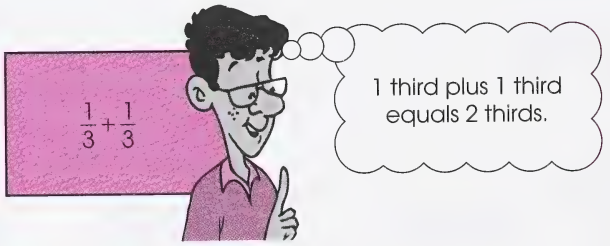
4. Lucy and Ruth are forwards on a field hockey team. In the last game Lucy scored $\frac{1}{2}$ of the goals and Ruth scored $\frac{1}{4}$ of the goals. What fraction of the goals did these two players score altogether?

5. Katrina likes to refinish furniture. This week she put two coats of varnish on a table. She used $\frac{1}{3}$ of a can of varnish for the first coat and $\frac{1}{4}$ of a can for the second coat. What fraction of a can did Katrina use altogether?

Check your answers by turning to the Appendix.

With practice you will discover that you can mentally compute the sum of two fractions. This is especially true if the denominators are the same or if one denominator is a multiple of the other.

Example 3



$\therefore \frac{1}{3}+\frac{1}{3}=\frac{2}{3}$

Example 4

$\therefore \frac{1}{2}+\frac{1}{8}=\frac{5}{8}$

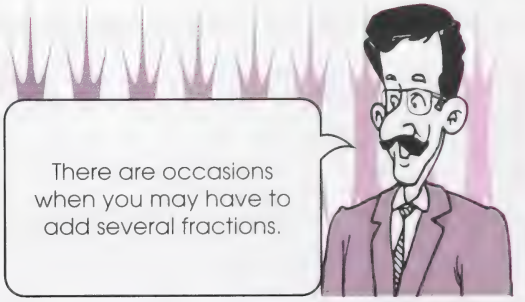
6. Mentally compute each of the following sums.

a. $\frac{1}{5}+\frac{2}{5}$ **b.** $\frac{1}{10}+\frac{6}{10}$ **c.** $\frac{1}{6}+\frac{4}{6}$

d. $\frac{1}{8}+\frac{1}{2}$ **e.** $\frac{2}{3}+\frac{1}{6}$ **f.** $\frac{2}{5}+\frac{3}{10}$

g. $\frac{3}{4} + \frac{1}{8}$ **h.** $\frac{1}{2} + \frac{3}{8}$ **i.** $\frac{5}{6} + \frac{1}{12}$

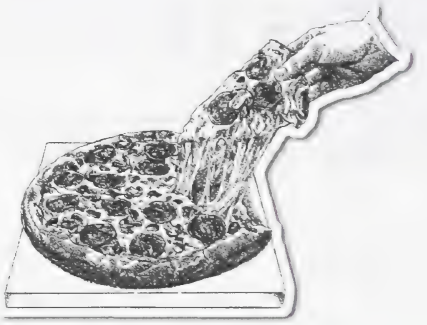
Check your answers by turning to the Appendix.



When you calculate the sum of several fractions, change all the fractions to equivalent fractions with a common denominator. Then add the numerators and keep the common denominator.

Example 5

The Baxter children had pizza for supper. Bill ate $\frac{3}{4}$ of a pizza. Richard ate $\frac{5}{8}$ of a pizza. Beth ate $\frac{3}{4}$ of a pizza. How much pizza did the Baxter children eat altogether?



Solution

Method 1: Adding Vertically

$$\begin{array}{r} \frac{3}{4} \\ \frac{5}{8} \\ +\ \frac{3}{4} \\ \hline \end{array} = \begin{array}{r} \frac{6}{8} \\ \frac{5}{8} \\ +\ \frac{6}{8} \\ \hline \end{array}$$

$$\frac{6+5+6}{8} = \frac{17}{8} = 2\frac{1}{8}$$

The Baxter children ate $2\frac{1}{8}$ pizzas.

Method 2: Adding Horizontally

$$\frac{3}{4}+\frac{5}{8}+\frac{3}{4} = \frac{6}{8}+\frac{5}{8}+\frac{6}{8}$$

$$= \frac{6+5+6}{8}$$

$$= \frac{17}{8}$$

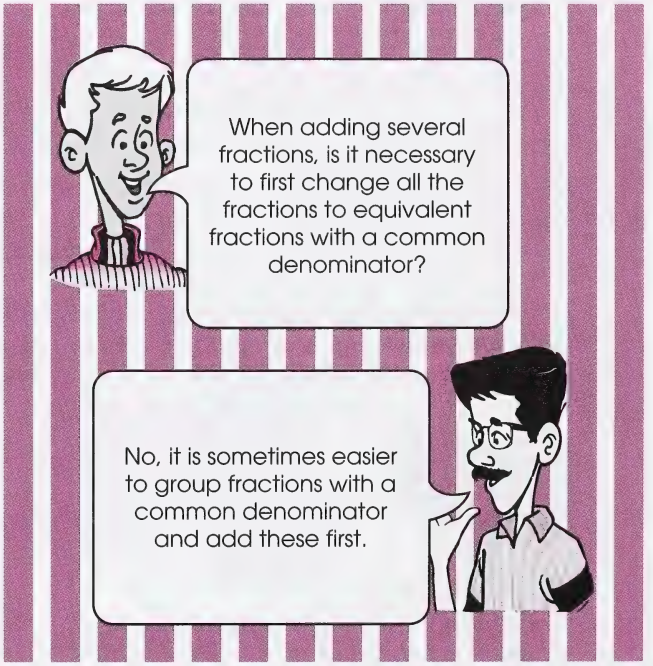
$$= 2\frac{1}{8}$$

The Baxter children ate $2\frac{1}{8}$ pizzas.

7. Use a paper-and-pencil method to compute each of the following sums.

a. $\frac{1}{8}+\frac{3}{4}+\frac{5}{8}$ **b.** $\frac{1}{2}+\frac{5}{6}+\frac{1}{3}$ **c.** $\frac{1}{4}+\frac{2}{3}+\frac{1}{2}$

Check your answers by turning to the Appendix.



Example 6

Evaluate the expression $\frac{2}{3}+\frac{1}{4}+\frac{1}{3}+\frac{1}{4}$.

Solution

$$\frac{2}{3}+\frac{1}{4}+\frac{1}{3}+\frac{1}{4}=\left(\frac{2}{3}+\frac{1}{3}\right)+\left(\frac{1}{4}+\frac{1}{4}\right)$$
$$=\frac{3}{3}+\frac{2}{4}$$
$$=1+\frac{1}{2}$$
$$=1\frac{1}{2}$$

8. Evaluate each of the following expressions. **Hint:** Group fractions with a common denominator and add these first.

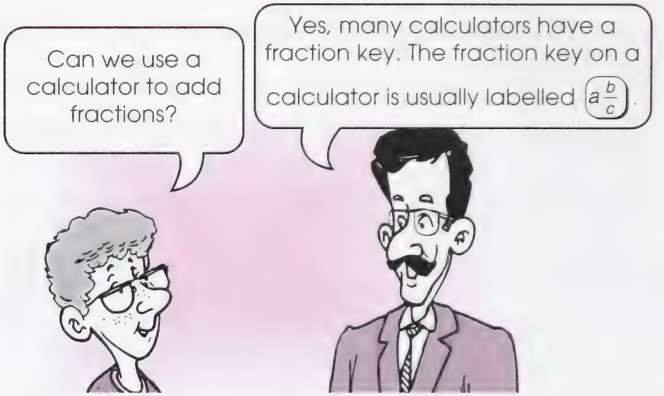
a. $\frac{1}{2}+\frac{2}{5}+\frac{3}{5}+\frac{3}{4}$

b. $\frac{2}{5}+\frac{1}{5}+\frac{3}{10}+\frac{2}{5}$

c. $\frac{1}{2}+\frac{3}{4}+\frac{1}{2}+\frac{7}{8}$

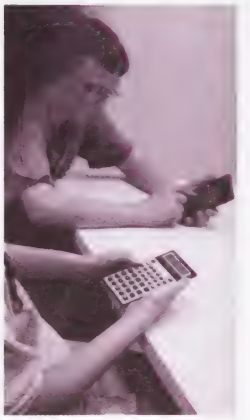
d. $\frac{1}{3}+\frac{1}{6}+\frac{1}{3}+\frac{1}{2}$

Check your answers by turning to the Appendix.



Fractions are usually not displayed in the standard manner on a calculator. The fraction $\frac{2}{3}$, for example, could be displayed in one of the following ways.

or



The mixed number $1\frac{3}{4}$, for example, could be displayed in one of the following ways.

or

The following example shows you how to use the fraction key. It is recommended that you first estimate the answer because it is easy to press a wrong key.

Example 7

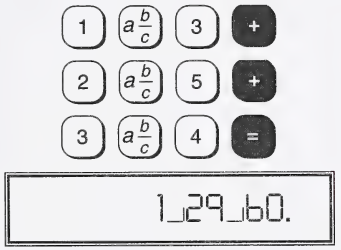
Use a calculator to evaluate the expression $\frac{1}{3}+\frac{2}{5}+\frac{3}{4}$.

Solution

Step 1: Estimate the answer.

$\frac{1}{3}+\frac{2}{5}+\frac{3}{4}$ is between 1 and 3.

Step 2: Press the following key sequence.



Step 3: Compare the calculated answer to the estimate.

Because $1\frac{29}{60}$ is between 1 and 3, the answer is reasonable.

Use a scientific calculator with a fraction key to answer question 9.

9. Estimate and then calculate the following sums.

a. $\frac{1}{2}+\frac{1}{3}+\frac{1}{4}$ **b.** $\frac{2}{3}+\frac{3}{5}+\frac{5}{6}$

Check your answers by turning to the Appendix.

Adding Mixed Numbers

When you add mixed numbers vertically, you line up the fractions and the whole numbers. First you add the fractions; then you add the whole numbers. Regrouping may be required.

Example 1

The children at the summer camp spent $1\frac{1}{2}$ h canoeing and $2\frac{1}{4}$ h making crafts. How much time did the children spend on these two activities?

Solution

Step 1: Line up the mixed numbers. If necessary, change the fraction parts to equivalent fractions with a common denominator. Add the fraction parts.

$$\begin{array}{r} 1\frac{1}{2} \\ +\ 2\frac{1}{4} \\ \hline \end{array} = \begin{array}{r} 1\ \frac{2}{4} \\ +\ 2\ \frac{1}{4} \\ \hline \frac{3}{4} \end{array}$$

Step 2: Add the whole number parts.

$$\begin{array}{r} 1\frac{1}{2} \\ +\ 2\frac{1}{4} \\ \hline \end{array} = \begin{array}{r} 1\ \frac{2}{4} \\ +\ 2\ \frac{1}{4} \\ \hline 3\ \frac{3}{4} \end{array}$$

The children spent $3\frac{3}{4}$ h on these two activities.

Example 2

Gina walked her dog for $2\frac{1}{2}$ h on Monday. She walked her dog for $1\frac{2}{3}$ h on Tuesday. For how long did Gina walk her dog on these two days?

Solution

Step 1: Line up the mixed numbers. If necessary, change the fraction parts to equivalent fractions with a common denominator. Add the fraction parts.

$$\begin{array}{r} 2\frac{1}{2} \\ +\ 1\frac{2}{3} \\ \hline \end{array} = \begin{array}{r} 2\ \frac{3}{6} \\ +\ 1\ \frac{4}{6} \\ \hline \frac{7}{6} \end{array} = \begin{array}{r} {\scriptstyle 1}\ \ \\ 2\ \frac{3}{6} \\ +\ 1\ \frac{4}{6} \\ \hline \frac{1}{6} \end{array}$$

This step can be done mentally.

$\frac{7}{6} = 1\frac{1}{6}$

Regrouping is required.

Step 2: Add the whole number parts.

$$\begin{array}{r} 2\frac{1}{2} \\ +\ 1\frac{2}{3} \\ \hline \end{array} = \begin{array}{r} {\scriptstyle 1}\ \ \\ 2\ \frac{3}{6} \\ +\ 1\ \frac{4}{6} \\ \hline 4\ \frac{1}{6} \end{array}$$

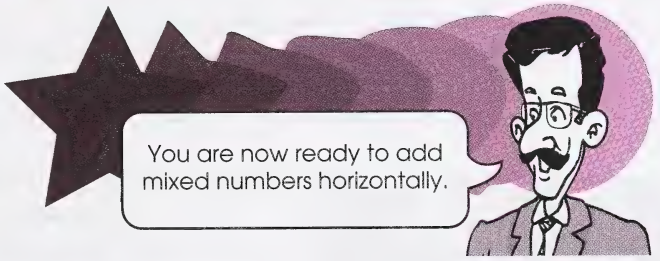
Gina walked the dog for $4\frac{1}{6}$ h on these two days.

10. Use the vertical method to evaluate each of the following expressions.

a. $3\frac{1}{10} + 1\frac{3}{5}$ **b.** $4\frac{1}{6} + 1\frac{2}{3}$ **c.** $5\frac{5}{6} + 1\frac{5}{12}$ **d.** $1\frac{3}{4} + 1\frac{1}{2}$

11. In a single year, one charitable foundation raised $\$10\frac{1}{2}$ million and another raised $\$8\frac{1}{3}$ million. How much money was collected altogether by the two charitable foundations?

Check your answers by turning to the Appendix.



When you add mixed numbers horizontally, first change the mixed numbers to improper fractions. Then add the improper fractions as you would proper fractions.

Example 3

Marcus read $3\frac{3}{4}$ books last month. Isaac read $1\frac{1}{2}$ books during the same period. How many books did the two boys read last month?

Solution

$$3\frac{3}{4}+1\frac{1}{2}=\frac{15}{4}+\frac{3}{2}$$ ← Change the mixed numbers to improper fractions.

$$=\frac{15}{4}+\frac{6}{4}$$ ← Find equivalent fractions with a common denominator.

$$=\frac{15+6}{4}$$

$$=\frac{21}{4}$$

$$=5\frac{1}{4}$$

The two boys read $5\frac{1}{4}$ books last month.

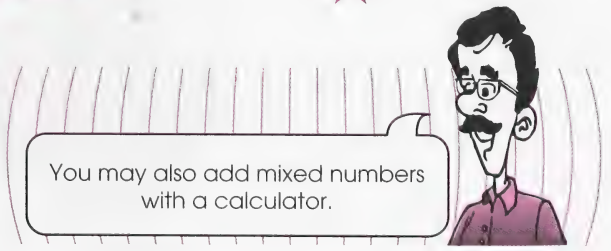
12. Use the horizontal method to evaluate each of the following expressions.

a. $1\frac{7}{8}+2\frac{3}{4}$ **b.** $1\frac{1}{5}+2\frac{3}{10}$ **c.** $1\frac{2}{3}+3\frac{3}{4}$

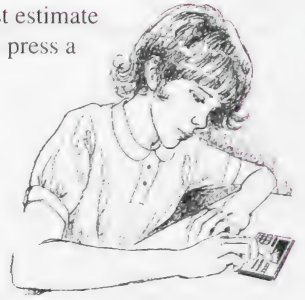
13. Mr. Crowell enjoys gardening. One week he transplanted $1\frac{3}{4}$ dozen tulips. The next week he transplanted $1\frac{1}{2}$ dozen tulips. How many dozen tulips did Mr. Crowell transplant altogether?

14. Franscesca enjoys her part-time job at the greenhouse. On Monday she worked $1\frac{3}{4}$ h. On Tuesday she worked another $2\frac{3}{4}$ h. Altogether, how much time did Franscesca work in the greenhouse on these two days? **Note:** This is the problem you considered at the beginning of this activity.

Check your answers by turning to the Appendix.



It is recommended that you first estimate the answer because it is easy to press a wrong key.



Example 4

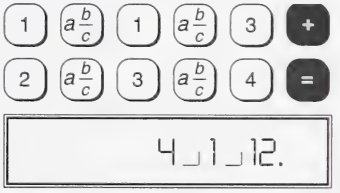
Use a calculator to evaluate the expression $1\frac{1}{3}+2\frac{3}{4}$.

Solution

Step 1: Estimate the answer.

Rounding	Front-end Digits
$1\frac{1}{3}+2\frac{3}{4}\doteq 1+3$	$1\frac{1}{3}+2\frac{3}{4}\doteq 1+2$
$\doteq 4$	$\doteq 3$

Step 2: Press the following key sequence.



Step 3: Compare the calculated answer with the estimate.

Rounding	Front-end Digits
$4\frac{1}{12} \doteq 4$	$4\frac{1}{12} \doteq 3$

The answer is reasonable.

$\therefore\ 1\frac{1}{3}+2\frac{3}{4}=4\frac{1}{12}$

Use a scientific calculator with a fraction key to do question 15.

15. Find the puzzle "Which Insects Most Often Fall in Love?" in the Appendix. Either photocopy or pull out the puzzle and then complete it.

Check your answer by turning to the Appendix.

Now Try This

At the end of each activity in this course, you will find at least one problem. Some of the problems deal with the topic of the activity. Others deal with a change of topic. The problem-solving strategies in the Appendix of Module 6 may help you solve these problems.

Use a problem-solving strategy to answer question 16.

16. The ancient Egyptians worked only with unit fractions—that is, fractions having a numerator of 1.

Express each of the following fractions as the sum of the fewest possible unit fractions.

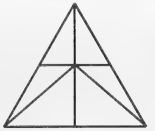
a. $\frac{3}{4}$ **b.** $\frac{5}{6}$ **c.** $\frac{11}{12}$ **d.** $\frac{7}{8}$

Check your answers by turning to the Appendix.

Use a problem-solving strategy to answer question 17.

17. This figure has three triangles in it; there is one large triangle and two small triangles.

How many triangles are in the following figure?



Check your answer by turning to the Appendix.

Many Canadians have been good at problem solving. Throughout this course you will find articles about Canadian discoveries and inventions.

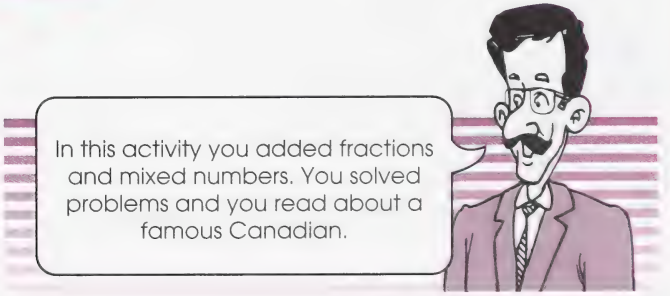
Did You Know?

Do you take rapid communication for granted? Happenings from across the world or outer space can be seen on television as they occur. Such instant communication was not always the case.

Did you know that a Canadian was involved in the world's first radio broadcast?

Find and read the article entitled "The World's First Radio Broadcast" in the Appendix. This article tells the story of Reginald Fessenden.

Use the Internet to discover more about Reginald Fessenden.

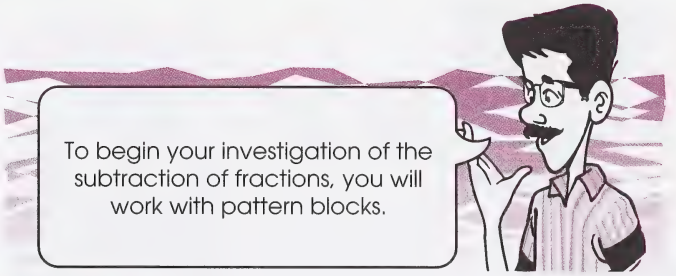


Activity 2: Subtracting

Tiffany and Gerhardt have part-time jobs working at a skate rental booth. Last week Tiffany worked for $9\frac{1}{2}$ h and Gerhardt worked for $8\frac{3}{4}$ h. How much longer than Gerhardt did Tiffany work?

By the time you complete this activity, you will be able to solve problems like this.

Subtracting Fractions

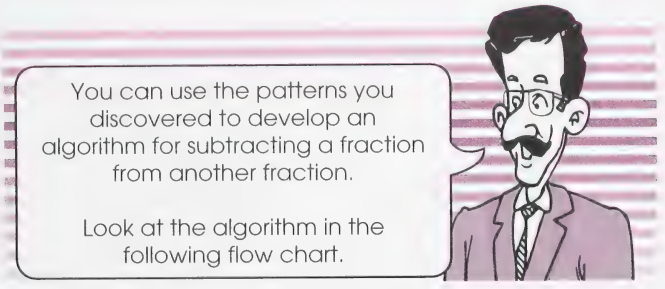


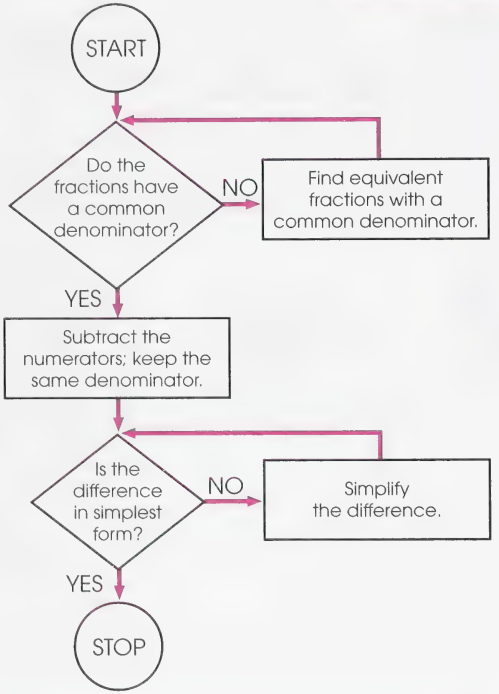
Gather your pattern blocks and the video program *Adding and Subtracting Fractions* from the series *Math Moves*.

1. View the segments on subtracting. (If you did not rewind the videocassette in Activity 2, continue from where you stopped.) Do the video assignments.

Check your answers by viewing the video program.

Note: Do not rewind the videocassette, as you will continue to view the program in the next activity. Also, save the pattern blocks for later use.





Notice how the algorithm is used in the following examples.

Example 1

Ahmed and Jacques each ordered a pizza. Ahmed ate $\frac{7}{8}$ of his pizza. Jacques ate $\frac{5}{8}$ of his pizza. How much more did Ahmed eat than Jacques?

Solution

Method 1: Subtracting Horizontally

The fractions have a common denominator.

$$\frac{7}{8}-\frac{5}{8}=\frac{7-5}{8}$$ ← Subtract the numerators; keep the common denominator.

$$=\frac{2}{8}$$ ← Simplify the difference.

$$=\frac{1}{4}$$

Ahmed ate $\frac{1}{4}$ of a pizza more than Jacques.

Method 2: Subtracting Vertically

$$\begin{array}{r} \frac{7}{8} \\ -\ \frac{5}{8} \\ \hline \end{array}$$

$$\frac{7-5}{8} = \frac{2}{8} = \frac{1}{4}$$

Ahmed ate $\frac{1}{4}$ of a pizza more than Jacques.

Note: Pictures may help you visualize the situation.

This diagram shows the fraction of Ahmed's pizza that was eaten. Ahmed ate 7 eighths of the pizza.

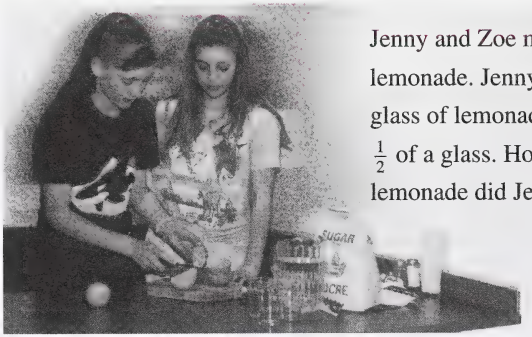
This diagram shows the fraction of Jacques' pizza that was eaten. Jacques ate 5 eighths of the pizza.

The following diagram shows the difference.

7 eighths – 5 eighths = 2 eighths
= 1 fourth

Ahmed ate $\frac{1}{4}$ of a pizza more than Jacques.

Example 2



Jenny and Zoe made lemonade. Jenny drank $\frac{3}{4}$ of a glass of lemonade. Zoe drank $\frac{1}{2}$ of a glass. How much more lemonade did Jenny drink?

Solution

Method 1: Subtracting Horizontally

The fractions do not have a common denominator.

$$\frac{3}{4} - \frac{1}{2} = \frac{3}{4} - \frac{2}{4}$$ ← Write equivalent fractions with a common denominator.

$$= \frac{3-2}{4}$$ ← Subtract the numerators; keep the common denominator.

$$= \frac{1}{4}$$

Jenny drank $\frac{1}{4}$ of a glass of lemonade more than Zoe.

Method 2: Subtracting Vertically

$$\begin{array}{r} \frac{3}{4} \\ -\ \frac{1}{2} \\ \hline \end{array} = \begin{array}{r} \frac{3}{4} \\ -\ \frac{2}{4} \\ \hline \end{array}$$

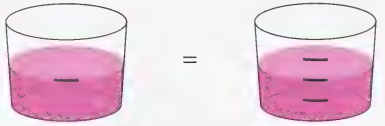
$$\frac{3-2}{4} = \frac{1}{4}$$

Jenny drank $\frac{1}{4}$ of a glass of lemonade more than Zoe.

Note: Pictures may help you visualize this situation.

This diagram shows the amount Jenny drank. Jenny drank 3 fourths of a glass of lemonade.

This diagram shows the amount Zoe drank. Zoe drank 1 half or 2 fourths of a glass of lemonade.



The following diagram shows the difference.

3 fourths – 2 fourths = 1 fourth

Jenny drank $\frac{1}{4}$ of a glass of lemonade more than Zoe.

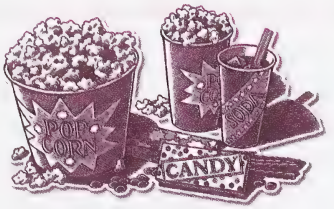
Use a paper-and-pencil method to answer questions 2 to 5.

2. The gas tank in the Yakimchuk's car was $\frac{7}{8}$ full when they left home. When they got to their cottage, the tank was $\frac{1}{8}$ full. How much gas did they use going to their cottage?

3. It took Lori $\frac{3}{4}$ h to walk from the library to the post office. It took her older sister $\frac{1}{4}$ h to walk the same route. How much longer did it take Lori to walk?

4. Jeremy's young brother, Frank, had a small garden. Frank planted $\frac{1}{4}$ of his garden with carrots. What fraction of his garden did he have for other plants?

5. After the movie, Jana had $\frac{1}{2}$ of a bag of popcorn left. She ate popcorn during the bus ride home. If she arrived home with $\frac{1}{3}$ of a bag of popcorn, how much popcorn did she eat on the bus?



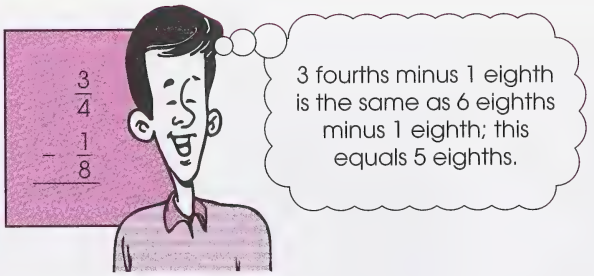
Check your answers by turning to the Appendix.

With practice you will discover that you can mentally compute the difference of two fractions. This is especially true if the denominators are the same or if one denominator is a multiple of the other.

Example 3

$\therefore \frac{3}{5} - \frac{1}{5} = \frac{2}{5}$

Example 4



$\therefore \frac{3}{4} - \frac{1}{8} = \frac{5}{8}$

6. Mentally compute each of the following differences.

a. $\frac{7}{8} - \frac{1}{8}$ **b.** $\frac{3}{4} - \frac{1}{2}$ **c.** $\frac{1}{2} - \frac{1}{4}$

d. $\begin{array}{r} \frac{2}{5} \\ -\ \frac{1}{10} \\ \hline \end{array}$ **e.** $\begin{array}{r} \frac{7}{12} \\ -\ \frac{1}{6} \\ \hline \end{array}$ **f.** $\begin{array}{r} \frac{5}{6} \\ -\ \frac{2}{3} \\ \hline \end{array}$

Check your answers by turning to the Appendix.

Subtracting Mixed Numbers

When subtracting mixed numbers vertically, line up the fraction parts and the whole numbers. If necessary, change the fraction parts to equivalent fractions with a common denominator. Subtract the fraction parts and then subtract the whole number parts. Regrouping may be required.

Example 1

Frances and Maria practise their music lessons for $2\frac{1}{2}$ h each day. If they practised for $1\frac{1}{4}$ h in the morning, how much practice time is left that day?

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Solution

Step 1: Line up the mixed numbers. If necessary, change the fraction parts to equivalent fractions with a common denominator. Subtract the fraction parts.

$$\begin{array}{r} 2\frac{1}{2} \\ -\ 1\frac{1}{4} \\ \hline \end{array} = \begin{array}{r} 2\ \frac{2}{4} \\ -\ 1\ \frac{1}{4} \\ \hline \frac{1}{4} \end{array}$$

$\frac{1}{2} = \frac{2}{4}$

No regrouping is required.

Step 2: Subtract the whole number parts.

$$\begin{array}{r} 2\frac{1}{2} \\ -\ 1\frac{1}{4} \\ \hline \end{array} = \begin{array}{r} 2\ \frac{2}{4} \\ -\ 1\ \frac{1}{4} \\ \hline 1\ \frac{1}{4} \end{array}$$

The girls have $1\frac{1}{4}$ h of practice time left.

Example 2

Robert has a summer job mowing lawns. He spent $4\frac{1}{4}$ h mowing lawns on Monday and $2\frac{1}{2}$ h mowing lawns on Tuesday. How much longer did he work on Monday than on Tuesday?

Solution

Step 1: Line up the mixed numbers. If necessary, change the fraction parts to equivalent fractions with a common denominator. Subtract the fraction parts.

$$\begin{array}{r} 4\frac{1}{4} \\ -\ 2\frac{1}{2} \\ \hline \end{array} = \begin{array}{r} 4\frac{1}{4} \\ -\ 2\frac{2}{4} \\ \hline \end{array} = \begin{array}{r} 3\ \frac{5}{4} \\ -\ 2\ \frac{2}{4} \\ \hline \quad\ \frac{3}{4} \end{array}$$

$4\frac{1}{4} = 3\frac{5}{4}$

Regrouping is required.

Step 2: Subtract the whole number parts.

$$\begin{array}{r} 4\frac{1}{4} \\ -\ 2\frac{1}{2} \\ \hline \end{array} = \begin{array}{r} 4\frac{1}{4} \\ -\ 2\frac{2}{4} \\ \hline \end{array} = \begin{array}{r} 3\ \frac{5}{4} \\ -\ 2\ \frac{2}{4} \\ \hline 1\ \frac{3}{4} \end{array}$$

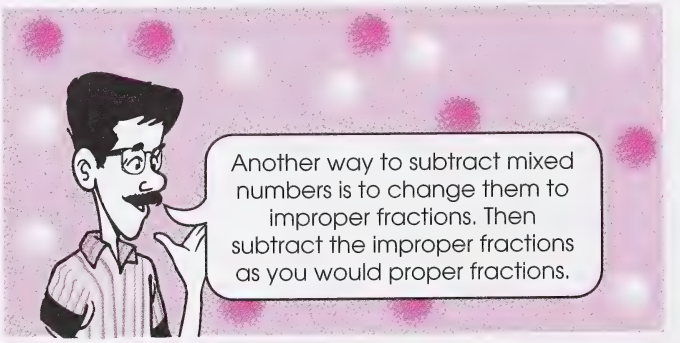
Robert spent $1\frac{3}{4}$ h longer mowing on Monday than on Tuesday.

7. Use the vertical method to evaluate each of the following expressions.

a. $\begin{array}{r} 3\frac{1}{2} \\ -\ 1\frac{1}{4} \\ \hline \end{array}$ **b.** $\begin{array}{r} 4\frac{3}{4} \\ -\ 1\frac{1}{2} \\ \hline \end{array}$ **c.** $\begin{array}{r} 5\frac{1}{8} \\ -\ 2\frac{3}{4} \\ \hline \end{array}$ **d.** $\begin{array}{r} 6\frac{1}{4} \\ -\ 3\frac{5}{8} \\ \hline \end{array}$

8. Tiffany and Gerhardt have part-time jobs working at a skate rental booth. Last week Tiffany worked for $9\frac{1}{2}$ h and Gerhardt worked for $8\frac{3}{4}$ h. How much longer than Gerhardt did Tiffany work? **Note:** This is the problem you considered at the beginning of this activity.

Check your answers by turning to the Appendix.



Example 3

Karen worked on a model airplane $3\frac{1}{2}$ h on Friday and $2\frac{3}{4}$ h on Saturday. How many more hours did she work on Friday than on Saturday?

Solution

$$3\frac{1}{2}-2\frac{3}{4}=\frac{7}{2}-\frac{11}{4}$$ ← Change the mixed numbers to improper fractions.

$$=\frac{14}{4}-\frac{11}{4}$$ ← Find equivalent fractions with a common denominator.

$$=\frac{3}{4}$$

Karen worked $\frac{3}{4}$ h more on Friday than on Saturday.

9. Use the horizontal method to evaluate each of the following expressions.

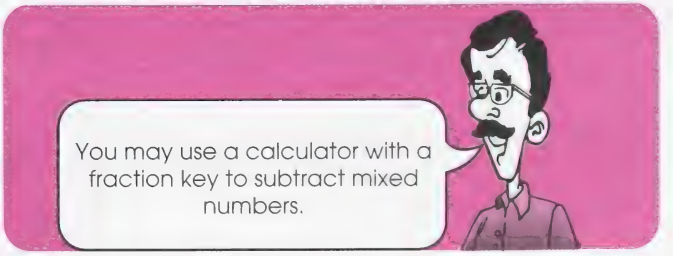
a. $5\frac{7}{8}-2\frac{3}{4}$

b. $4\frac{2}{5}-2\frac{7}{10}$

c. $5\frac{1}{6}-3\frac{7}{12}$

10. George had 4 chairs to paint. If he painted $1\frac{1}{2}$ chairs on Saturday, how many must he still paint to complete the job?

Check your answers by turning to the Appendix.



Example 4

Evaluate the expression $3\frac{1}{2} - 1\frac{3}{4}$.

Solution

Step 1: Estimate the answer.

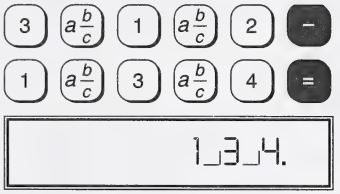
Rounding

$$3\frac{1}{2} - 1\frac{3}{4} \doteq 4 - 2$$
$$\doteq 2$$

Front-end Digits

$$3\frac{1}{2} - 1\frac{3}{4} \doteq 3 - 1$$
$$\doteq 2$$

Step 2: Press the following key sequence.



Step 3: Compare the calculated answer to the estimate.

Rounding

$$1\frac{3}{4} \doteq 2$$

Front-end Digits

$$1\frac{3}{4} \doteq 2$$

The answer is reasonable.

$$\therefore\ 3\frac{1}{2} - 1\frac{3}{4} = 1\frac{3}{4}$$

Use a scientific calculator with a fraction key to answer question 11.

11. Find the puzzle entitled "Where Do Trees Go When One Tree Has a Birthday?" in the Appendix. Either photocopy or pull out the sheet and then complete the puzzle.

Check your answer by turning to the Appendix.

Now Try This

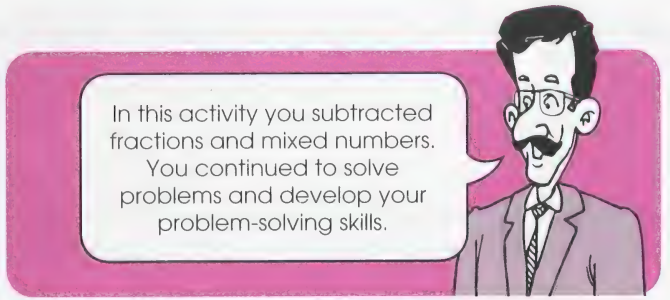
Use a problem-solving strategy to answer each of the following questions.

12. Arrange 4 pennies on a table so that each penny touches every other penny.

13. There are six coins in a bag. They all look alike but one is counterfeit. It is lighter than the others.

Explain how you can find the fake coin in two weighings using a two-pan balance.

Check your answers by turning to the Appendix.



Activity 3: Multiplying

A recipe calls for $4\frac{1}{2}$ medium carrots. How many carrots will be required for twice the recipe? How many will be needed for half of the recipe?

By the end of this activity, you will be able to solve problems like this.

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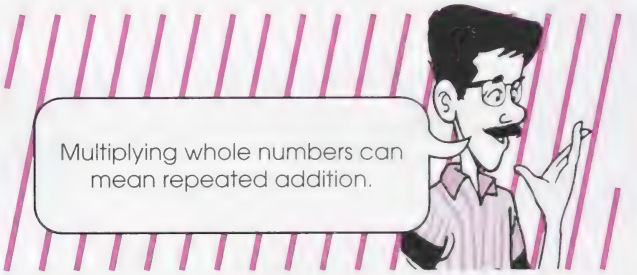
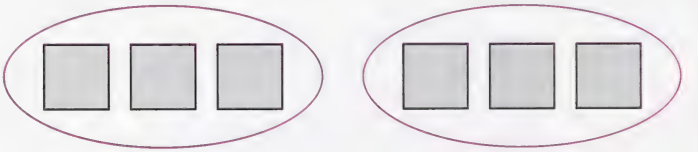
Multiplying Whole Numbers



For example, the expression 2×3 means, "2 groups of 3 objects is **how many objects**?" As the following diagram shows, "2 groups of 3 objects is **6 objects**."

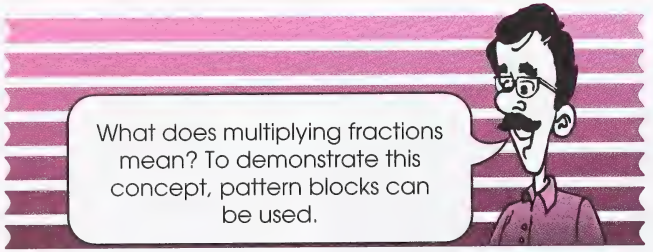


The value of $2 \times 3 = 6$ because $3 + 3 = 6$.

In the mathematical statement $2 \times 3 = 6$, the numbers 2 and 3 are called **factors**. The number 6 is called the **product**.

Factors are numbers that are multiplied. The product is the result of multiplying.

Multiplying Fractions

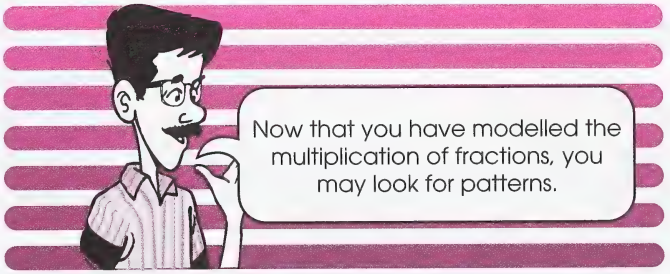


Gather your pattern blocks and the video program *Multiplying and Dividing Fractions* from the series *Math Moves*.

1. View the segments involving multiplication. (You may fast-forward through the introduction of the program because it is the same as the introduction to the video program you viewed earlier.) Do the video assignments.

Check your answers by viewing the video program.

Note: Do not rewind the videocassette as you will continue to view the program later in this section. You will also continue to use your pattern blocks.



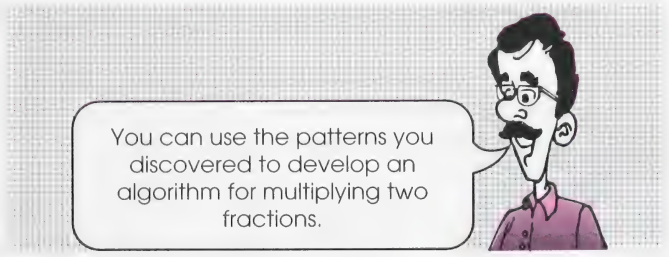
2. Use the given mathematical statements to answer the following questions.

$$\frac{1}{3}\times\frac{3}{4}=\frac{3}{12} \qquad \frac{2}{3}\times\frac{3}{4}=\frac{6}{12}$$
$$=\frac{1}{4} \qquad =\frac{1}{2}$$

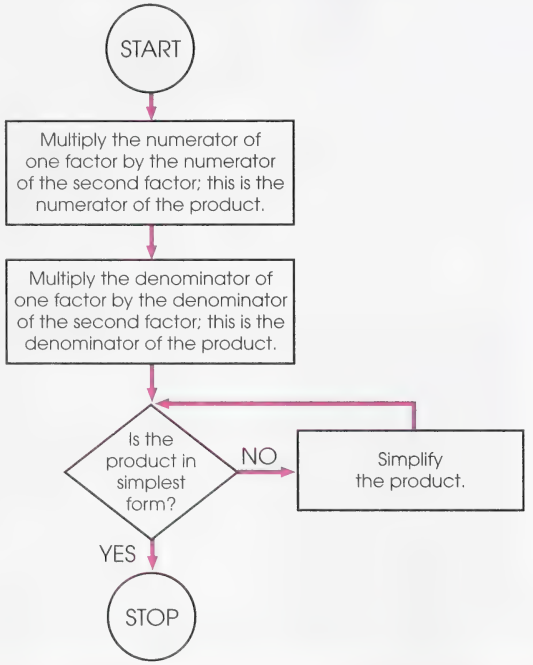
a. What relationship is there between the numerator of each answer (before it is simplified) and the numerators of the factors?

b. What relationship is there between the denominator of each answer (before it is simplified) and the denominators of the factors?

Check your answers by turning to the Appendix.



The algorithm for multiplying fractions is given in the following flow chart.



Notice how the algorithm is used in the following examples.

Example 1

There was $\frac{1}{2}$ of a cake in the refrigerator. Henri ate $\frac{2}{3}$ of this portion. What fraction of the whole cake did he eat?

Solution

$$\frac{2}{3}\times\frac{1}{2}=\frac{2\times1}{3\times2}$$ ← Multiply the numerators. ← Multiply the denominators.

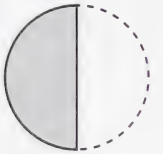
$$=\frac{2}{6}$$ ← Simplify.

$$=\frac{1}{3}$$

Henri ate $\frac{1}{3}$ of the whole cake.

Note: Pictures may help you visualize this situation.

This diagram shows 1 half of the cake.



The expression $\frac{2}{3}\times\frac{1}{2}$ means, "2 of 3 equal parts of 1 half is **how much** of the whole?"

Because 1 half cannot be grouped into three equal parts, the fraction needs to be renamed as 3 sixths.

Ask yourself, "2 of 3 equal parts of 3 sixths is **how much** of the whole?"

The darker region in this diagram shows 2 of 3 equal parts of 3 sixths. This is the part Henri ate.

As the following diagram shows, the part Henri ate is **2 sixths**, or **1 third**, of the entire cake.

Example 2

Sarah rototilled $\frac{3}{5}$ of her garden. Then she planted $\frac{1}{2}$ of the rototilled area. What fraction of the entire garden did Sarah plant?

Solution

$$\frac{1}{2}\times\frac{3}{5}=\frac{1\times 3}{2\times 5}$$

← Multiply the numerators.

← Multiply the denominators.

$$=\frac{3}{10}$$

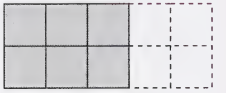
Sarah planted $\frac{3}{10}$ of the garden.

Note: Pictures may help you visualize the situation.

This diagram shows the part of the whole garden that was rototilled. It is 3 fifths of the whole garden.

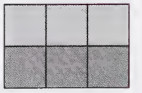
The expression $\frac{1}{2}\times\frac{3}{5}$ means, "1 of 2 equal parts of 3 fifths is **how much** of the whole?"

Because 3 fifths cannot be grouped into two equal parts, the fraction needs to be renamed 6 tenths.

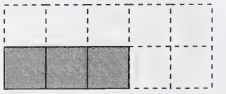


Ask yourself, "1 of 2 equal parts of 6 tenths is **how much** of the whole?"

The darker region in this diagram shows 1 of 2 equal parts of 6 tenths. This is the part that was planted.



As this diagram shows, Sarah planted **3 tenths** of the entire garden.



Use the paper-and-pencil method to answer questions 3 to 6.

3. Julio mowed part of the lawn in the morning and left $\frac{3}{4}$ of the lawn unmowed. In the afternoon he mowed $\frac{1}{2}$ of unmowed area. What fraction of the entire lawn did Julio mow in the afternoon?

4. Dale can walk from his home to the store in $\frac{3}{4}$ of an hour. He can ride his bike this distance in $\frac{1}{3}$ of that time. What fraction of an hour does it take Dale to ride his bike from his home to the store?

5. Mrs. Chase baked a batch of cookies. She put raisins in $\frac{1}{2}$ of the cookies. Then she frosted $\frac{1}{2}$ of the cookies with raisins in them. What fraction of the entire batch of cookies had raisins and were frosted?

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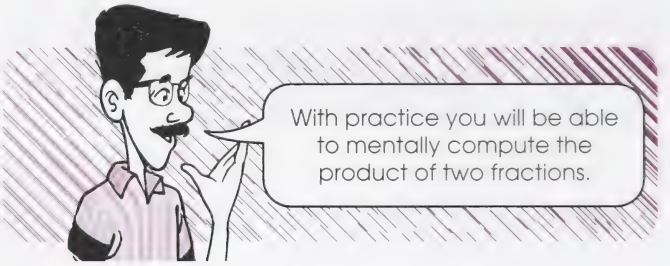
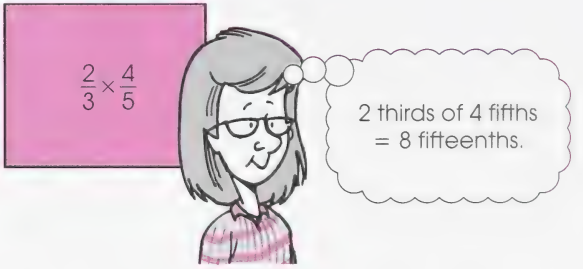
6. During lunch at a local restaurant $\frac{1}{3}$ of the customers purchased salad. Of the people who bought salad, $\frac{3}{4}$ also ordered soup. What fraction of the customers had both soup and salad?

Check your answers by turning to the Appendix.



Example 3

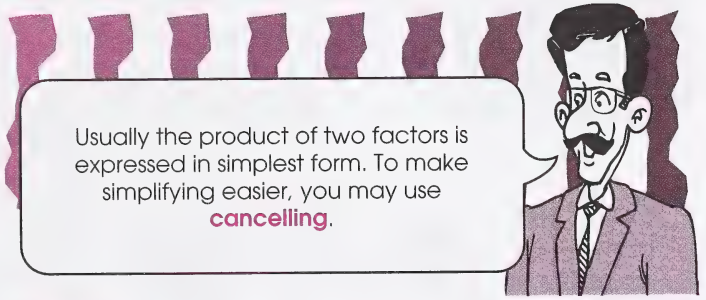


$\therefore \frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$

7. Mentally compute each of the following products.

a. $\frac{1}{3}\times\frac{1}{2}$ b. $\frac{3}{4}\times\frac{3}{5}$ c. $\frac{2}{3}\times\frac{4}{5}$

Check your answers by turning to the Appendix.



In multiplication, cancelling is the process of dividing a numerator and a denominator by a common factor.

Example 4

Phillipe gave Juan $\frac{1}{2}$ of his chocolate bar. If Juan ate $\frac{2}{3}$ of the bar Phillipe gave him, what fraction of the original chocolate bar did Juan eat?

Solution

$$\frac{1}{2}\times\frac{2}{3}=\frac{1\times\cancel{2}^{1}}{\cancel{2}_{1}\times 3}$$ ← Simplify by dividing the numerator and the denominator by 2.

$$=\frac{1\times 1}{1\times 3}$$

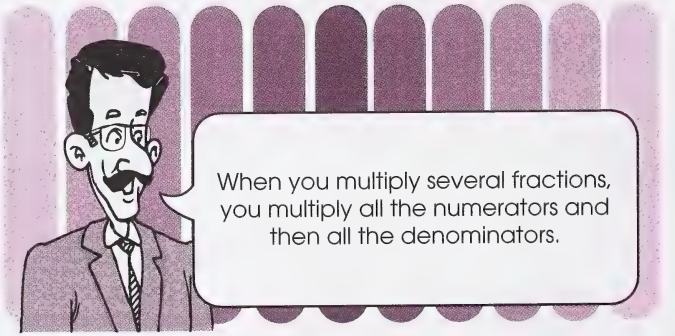
$$=\frac{1}{3}$$

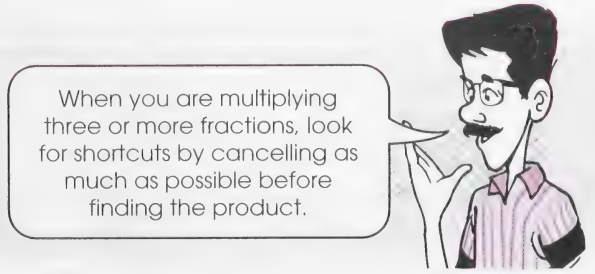
$\frac{2}{2}=\frac{1}{1}$

Juan ate $\frac{1}{3}$ of the original chocolate bar.

8. Find the puzzle entitled "Superstar" in the Appendix of this module. Either photocopy or pull out the sheet and complete the puzzle.

Check your answer by turning to the Appendix.





Example 5

Roxanne had $\frac{3}{4}$ of a container of candies. Roxanne gave $\frac{2}{3}$ of her candies to Morris. Morris, in turn, gave $\frac{1}{2}$ of his candies to Floyd. What fraction of the container of candies did Floyd receive?

Solution

$$\frac{1}{2}\times\frac{2}{3}\times\frac{3}{4}=\frac{1\times\overset{1}{\cancel{2}}\times\overset{1}{\cancel{3}}}{\underset{1}{\cancel{2}}\times\underset{1}{\cancel{3}}\times 4}$$ ← Simplify by dividing the numerator and the denominator by 2 and 3.

$$=\frac{1\times 1\times 1}{1\times 1\times 4}$$

$$=\frac{1}{4}$$

$\frac{2}{2}=\frac{1}{1};\ \frac{3}{3}=\frac{1}{1}$

Floyd received $\frac{1}{4}$ of the container of candies.

Note: Different combinations of factors in the numerator and the denominator may be cancelled. Here is another way to cancel.

$$\frac{1}{2}\times\frac{2}{3}\times\frac{3}{4}=\frac{1\times\overset{1}{\cancel{2}}\times\overset{1}{\cancel{3}}}{2\times\underset{1}{\cancel{3}}\times\underset{2}{\cancel{4}}}$$ ← Simplify by dividing the numerator and the denominator by 2 and 3.

$$=\frac{1\times 1\times 1}{2\times 1\times 2}$$

$$=\frac{1}{4}$$

$\frac{2}{4}=\frac{1}{2};\ \frac{3}{3}=\frac{1}{1}$

9. Compute each of the following products. Cancel wherever possible.

a. $\frac{7}{8}\times\frac{4}{5}\times\frac{5}{8}$

b. $\frac{1}{4}\times\frac{3}{5}\times\frac{2}{3}$

c. $\frac{3}{5}\times\frac{4}{9}\times\frac{5}{6}$

d. $\frac{2}{3}\times\frac{5}{6}\times\frac{9}{10}$

10. Find the product of each of the following expressions.

a. $\frac{1}{2}\times\frac{2}{3}$ **b.** $\frac{1}{2}\times\frac{2}{3}\times\frac{3}{4}$ **c.** $\frac{1}{2}\times\frac{2}{3}\times\frac{3}{4}\times\frac{4}{5}$

11. What pattern do you notice in question 10?

12. Use the pattern you discovered in question 11 to evaluate the following expression.

$$\frac{1}{2}\times\frac{2}{3}\times\frac{3}{4}\times\frac{4}{5}\times\cdots\times\frac{49}{50}$$

The three dots indicate that the factors between $\frac{4}{5}$ and $\frac{49}{50}$ are not shown, but the pattern of factors continues.

Check your answers by turning to the Appendix.

Multiplying Mixed Numbers

To multiply mixed numbers, first change the mixed numbers to improper fractions. Then multiply as you would proper fractions.

Example 1

Sue can skate $2\frac{1}{2}$ laps of the pond in 1 h. How many laps can she skate in $1\frac{1}{4}$ h?

Solution

$$1\frac{1}{4}\times 2\frac{1}{2}=\frac{5}{4}\times\frac{5}{2}$$ ← Change the mixed numbers to improper fractions.

$$=\frac{5\times 5}{4\times 2}$$

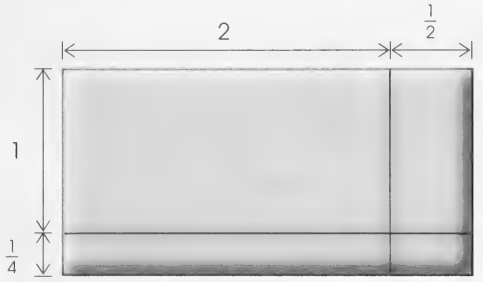
$$=\frac{25}{8}$$

$$=3\frac{1}{8}$$

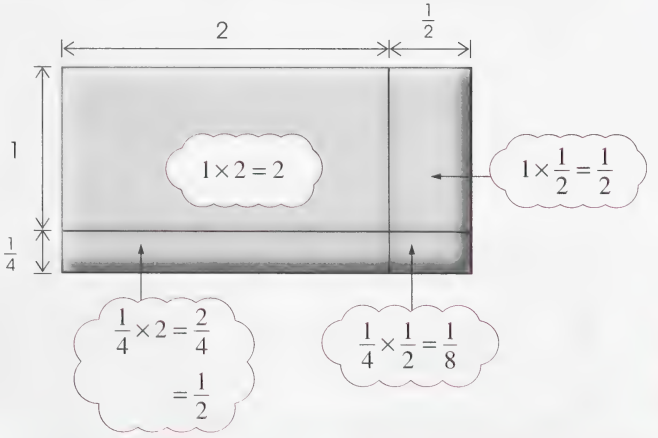
Sue can skate $3\frac{1}{8}$ laps in $1\frac{1}{4}$ h.

Note: Pictures may help you visualize the situation.

This large rectangle represents $1\frac{1}{4} \times 2\frac{1}{2}$. Notice that there are four sections in the rectangle.



To find the product of $1\frac{1}{4}$ and $2\frac{1}{2}$, ask yourself, "What is the area of each section?" This can be calculated mentally. The following diagram shows the area of each section.



Ask yourself, "What is the total area of the four sections?" This can be calculated mentally.

$$2 + \frac{1}{2} + \frac{1}{2} + \frac{1}{8}$$
$$= 2 + \left(\frac{1}{2} + \frac{1}{2}\right) + \frac{1}{8}$$
$$= 2 + 1 + \frac{1}{8}$$
$$= 3\frac{1}{8}$$

$\therefore\ 1\frac{1}{4} \times 2\frac{1}{2} = 3\frac{1}{8}$

13. Evaluate each of the following. Use pictures to illustrate each product.

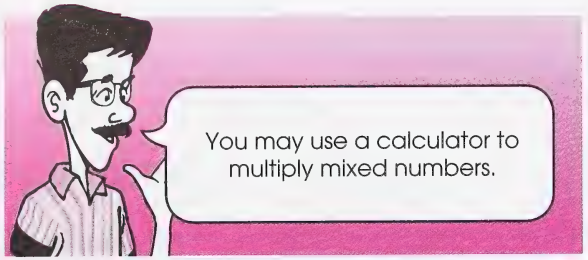
a. $1\frac{3}{5} \times 2\frac{1}{2}$ **b.** $2\frac{4}{5} \times 3\frac{1}{2}$ **c.** $1\frac{1}{6} \times 4\frac{2}{3}$

14. A recipe calls for $4\frac{1}{2}$ medium carrots.

a. How many carrots will be required for twice the recipe?
b. How many carrots will be required for half of the recipe?

Note: This is the problem you considered at the beginning of this activity.

Check your answers by turning to the Appendix.



Example 2

Evaluate the expression $3\frac{7}{8} \times 4\frac{1}{3}$.

Solution

Step 1: Estimate the answer.

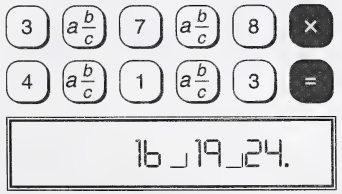
Rounding

$$3\frac{7}{8} \times 4\frac{1}{3} \doteq 4 \times 4$$
$$\doteq 16$$

Front-end Digits

$$3\frac{7}{8} \times 4\frac{1}{3} \doteq 3 \times 4$$
$$\doteq 12$$

Step 2: Press the following key sequence.



Step 3: Compare the calculated answer to the estimate.

Rounding

$$16\frac{19}{24} \doteq 16$$

Front-end Digits

$$16\frac{19}{24} \doteq 12$$

The answer is reasonable.

$$\therefore\ 3\frac{7}{8} \times 4\frac{1}{3} = 16\frac{19}{24}$$

Use a scientific calculator with a fraction key to answer questions 15 and 16.

15. When knitting, the size of the knitting needles and the kind of yarn will affect the tension. Tension is measured by the number of stitches in a square that is 2.5 cm by 2.5 cm.

Frieda used two different brands of yarn but the same needles to knit two afghans. She then measured a 2.5-cm square from each afghan to compare the tension. She discovered the first square had $5\frac{1}{4}$ rows with $4\frac{1}{4}$ stitches per row. The second square had $5\frac{1}{2}$ rows with $3\frac{1}{2}$ stitches per row.

a. How many stitches were in the first square?
b. How many stitches were in the second square?

16. Find the puzzle entitled "Hidden Message" in the Appendix. Either photocopy or pull out the page and then complete the puzzle.

Check your answers by turning to the Appendix.

Now Try This

Use a problem-solving strategy to answer the following question.

17. There were 20 people at a meeting. The only languages spoken by the people at the meeting were French and English. Of the group, $\frac{3}{4}$ of the people spoke French and $\frac{4}{5}$ of the people spoke English.

a. How many spoke only English?

b. How many spoke only French?

c. How many spoke both French and English?

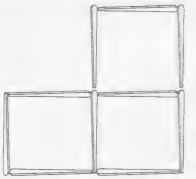
Check your answers by turning to the Appendix.

Use a problem-solving strategy to answer the following question.

18. The minimum number of toothpicks required to build 1 square is 4.

The minimum number of toothpicks required to make 2 identical squares is 7.

The minimum number of toothpicks needed to make 3 identical squares is 10.

 **or** 

a. What is the minimum number of toothpicks needed to make 4 identical squares?

b. What is the minimum number of toothpicks needed to make 5 identical squares?

c. What is the minimum number of toothpicks needed to make 6 identical squares?

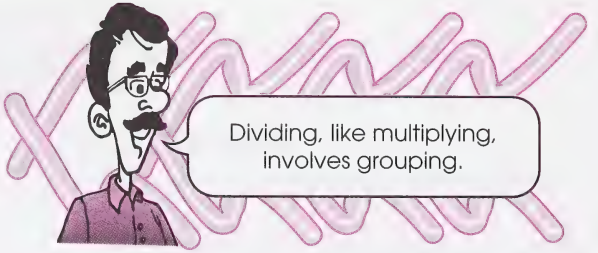
Check your answers by turning to the Appendix.

Activity 4: Dividing

In the summer Roger's father commutes to the office from his cottage. The family car uses $\frac{1}{4}$ of a tank of gas to travel from the cottage to the office. If the car has $\frac{3}{4}$ of a tank of gas, how many trips between his cottage and the office can Roger's father make?

By the time you finish this activity you will be able to solve problems like this.

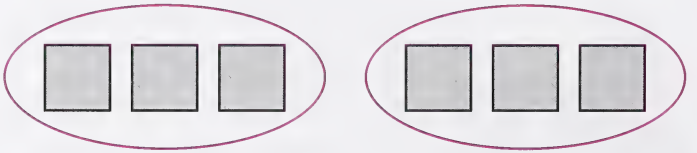
Dividing by Whole Numbers



Sometimes dividing involves finding how many objects (or people or animals) are in each group.

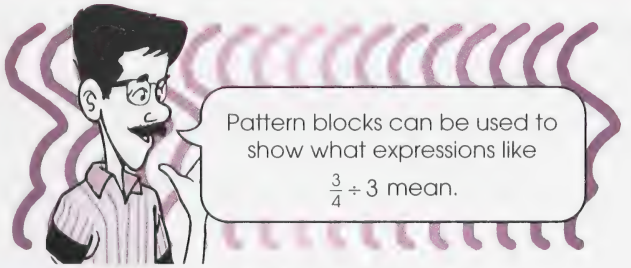
For example, the expression $6 \div 2$ can mean, "In 6 there are 2 groups of **how many objects**?"

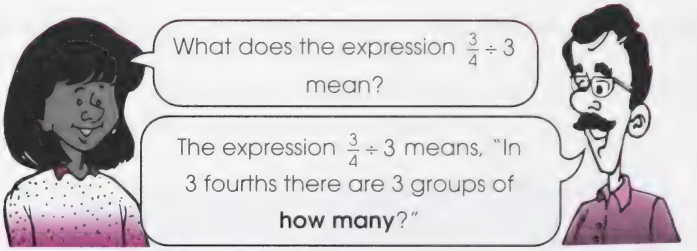
As the diagram shows, 6 objects can be arranged in 2 groups of **3 objects**.



In the mathematical statement $6 \div 2 = 3$, the number 6 is the **dividend**, 2 is the **divisor**, and 3 is the **quotient**.

The dividend is the number which is to be divided. The divisor is the number by which the dividend is to be divided. The quotient is the number resulting from the division.





Gather your pattern blocks and the video program *Multiplying and Dividing Fractions* from the series *Math Moves*.

1. View the segment entitled "Dividing Fractions by Whole Numbers." (If you did not rewind the video after viewing the multiplication segments, continue viewing from where you stopped.) Do the video assignments.

Check your answers by viewing the video program.

Note: Do not rewind the videocassette as you will continue viewing it in this activity. Also save the pattern blocks.

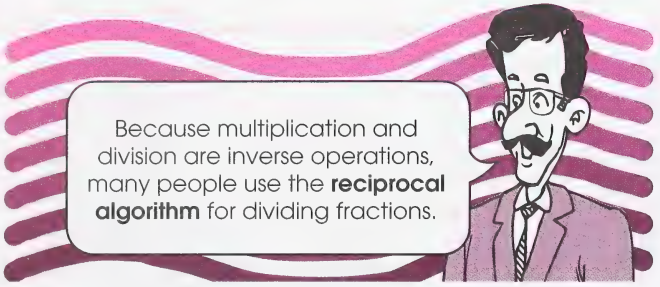
2. Does dividing $\frac{3}{4}$ by 3 produce the same result as multiplying $\frac{3}{4}$ by $\frac{1}{3}$? Illustrate this by modelling $\frac{3}{4} \div 3$ and $\frac{1}{3} \times \frac{3}{4}$.

Check your answer by turning to the Appendix.

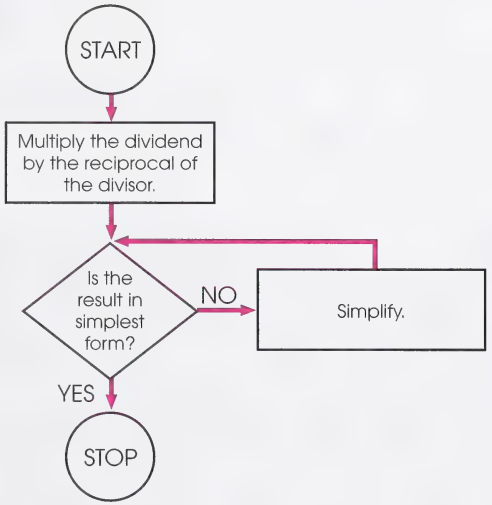
You have discovered that dividing 3 fourths by 3 produces the same result as multiplying 3 fourths by 1 third.

The operations of multiplication and division are **inverse operations**. The numbers 3 and $\frac{1}{3}$ are **multiplicative inverses**.

Inverse operations are operations that undo each other. Two numbers are multiplicative inverses if their product is 1. Multiplicative inverses are also called **reciprocals**.

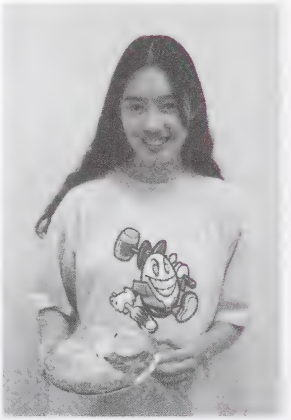


The reciprocal algorithm for dividing fractions is given in the following flow chart.



The reciprocal algorithm for dividing fractions is used in the following examples.

Example 1



Cordellia has $\frac{5}{6}$ of a pie. If 5 children share this remaining part of the pie, what fraction of the whole pie will each child receive?

Solution

$$\frac{5}{6} \div 5 = \frac{5}{6} \times \frac{1}{5} \quad \longleftarrow \text{Multiply the dividend by the reciprocal of the divisor.}$$

$$= \frac{\overset{1}{\cancel{5}} \times 1}{6 \times \underset{1}{\cancel{5}}}$$

$$= \frac{1 \times 1}{6 \times 1}$$

$$= \frac{1}{6}$$

Each child will receive $\frac{1}{6}$ of the whole pie.

Note: Pictures may help you visualize the situation.

The following diagram shows the fraction of the pie that will be shared by 5 children. There is 5 sixths of a pie.

The expression $\frac{5}{6} \div 5$ can mean, "In 5 sixths there are 5 groups of **how many**?"

As the following diagram shows, there are 5 groups of **1 sixth**.

Each child will receive $\frac{1}{6}$ of the whole pie.

Example 2

Suki and Anneka share $\frac{3}{4}$ of a pizza. What fraction of the pizza will each girl receive?

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Solution

$$\frac{3}{4} \div 2 = \frac{3}{4} \times \frac{1}{2}$$ ← Multiply the dividend by the reciprocal of the divisor

$$= \frac{3 \times 1}{4 \times 2}$$

$$= \frac{3}{8}$$

Each girl will receive $\frac{3}{8}$ of the pizza.

Note: Pictures may help you visualize the situation.

The following diagram shows the fraction of the pizza that the 2 girls share (3 fourths of a pizza).

The expression $\frac{3}{4} \div 2$ can mean, "In 3 fourths there are 2 groups of **how many**?"

In order to answer this question, you must rename 3 fourths as 6 eighths.

Ask yourself, "In 6 eighths there are 2 groups of **how many**?"

As the following diagram shows, there are 2 groups of **3 eighths**.

Each girl will receive $\frac{3}{8}$ of the whole pizza.

Use the reciprocal algorithm to answer questions 3 and 4.

3. Fred has $\frac{7}{12}$ of a carton of eggs. If he divides the eggs among 7 people, what part of the carton will each person receive?

4. Myrtle volunteers for $\frac{3}{4}$ h at a community hospital. If she divides her time equally doing 9 tasks, how much time will she spend on each task?

Check your answers by turning to the Appendix.

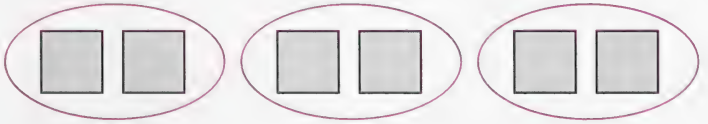
Dividing by Fractions

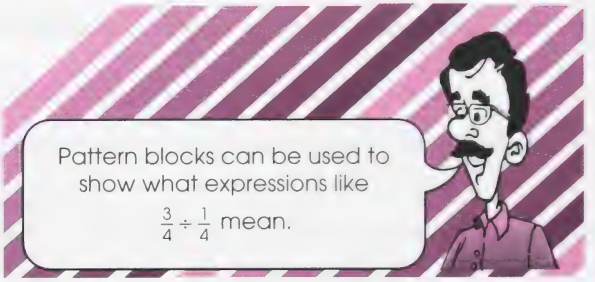
In the problems you have investigated you asked yourself questions like "6 can be divided into 2 groups of **how many**?" or "$\frac{3}{4}$ can be divided into 3 groups of **how many**?"

Sometimes you want to know how many **groups** can be made.

For example, the expression $6 \div 2$ can mean, "In 6 there are **how many groups** of 2?"

As the following diagram shows, 6 objects can be arranged into **3 groups** of 2 objects.

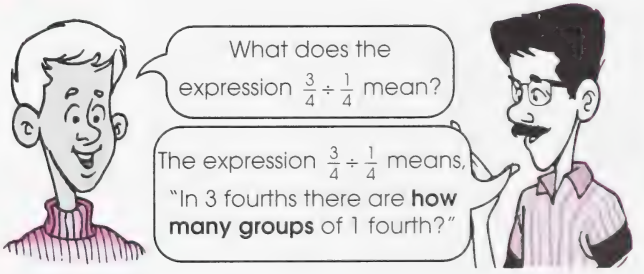


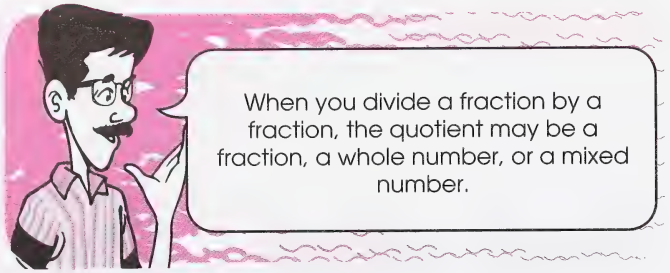


Gather your pattern blocks and the video program *Multiplying and Dividing Fractions* from the series *Math Moves*.

5. Continue viewing the remaining segments on division of fractions. Do the video assignments.

Check your answers by viewing the video program.

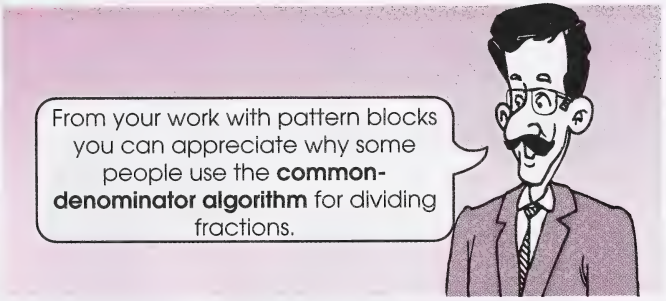




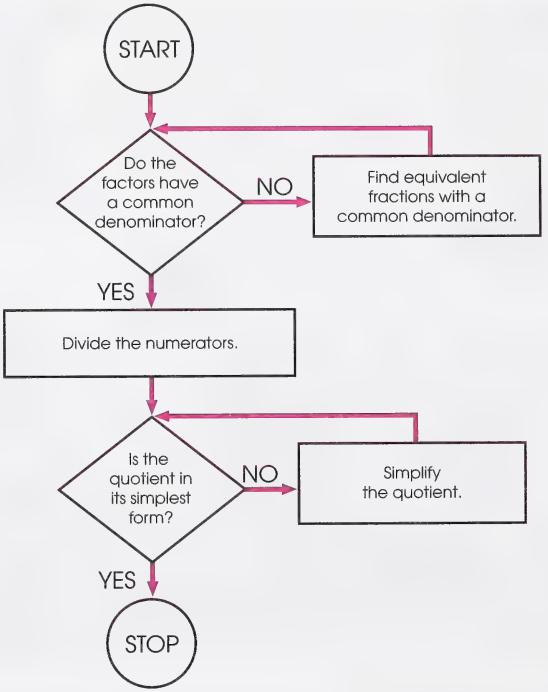
For example, $\frac{5}{12} \div \frac{7}{12} = \frac{5}{7}$; $\frac{5}{6} \div \frac{1}{12} = 10$; and $\frac{3}{4} \div \frac{1}{2} = 1\frac{1}{2}$.

6. **a.** When is the quotient of two fractions less than 1?
b. When is the quotient of two fractions greater than 1?

Check your answers by turning to the Appendix.



The common-denominator algorithm for dividing fractions is given in the following flow chart.



Of course, you may also use the reciprocal algorithm for dividing two fractions.

The following examples illustrate the use of the two algorithms.

Example 1

If Mr. Petruk can read one newspaper page in $\frac{1}{12}$ h, how many pages can he read in $\frac{1}{4}$ h?

Solution

Method 1: The Reciprocal Algorithm

$$\frac{1}{4} \div \frac{1}{12} = \frac{1}{4} \times \frac{12}{1}$$ ← Multiply the dividend by the reciprocal of the divisor.

$$= \frac{1 \times \overset{3}{\cancel{12}}}{\underset{1}{\cancel{4}} \times 1}$$

$$= \frac{1 \times 3}{1 \times 1}$$

$$= \frac{3}{1}$$

$$= 3$$

In $\frac{1}{4}$ h, Mr. Petruk can read 3 pages.

Method 2: The Common-Denominator Algorithm

$$\frac{1}{4} \div \frac{1}{12} = \frac{3}{12} \div \frac{1}{12}$$ ← Find an equivalent fraction with a common denominator.

$$= 3 \div 1$$ ← Divide the numerators.

$$= 3$$

Mr. Petruk can read 3 pages in $\frac{1}{4}$ h.

Note: Pictures can help you visualize the situation.

This diagram shows the time available to read. It is 1 fourth of an hour.

This diagram shows the time required by Mr. Petruk to read one page. It is 1 twelfth of an hour.

The expression $\frac{1}{4} \div \frac{1}{12}$ can mean, "**How many groups** of 1 twelfth are there in 1 fourth?"

Because the fractions do not have a common denominator, 1 fourth must be renamed 3 twelfths.

Ask yourself, "**How many groups** of 1 twelfth are there in 3 twelfths?"

Since the divisor 1 twelfth is less than the dividend 3 twelfths, there will be more than 1 group.

From the diagram you can see that there are **3 groups** of 1 twelfth in 3 twelfths.

In $\frac{1}{4}$ h, Mr. Petruk can read 3 pages.

Example 2

Hally paints clown faces. If Hally can paint a clown face in $\frac{1}{2}$ h, how many faces can she paint in $\frac{1}{4}$ h?

Solution

Method 1: The Reciprocal Algorithm

$$\frac{1}{4} \div \frac{1}{2} = \frac{1}{4} \times \frac{2}{1}$$ ← Multiply the dividend by the reciprocal of the divisor.

$$= \frac{1 \times \cancel{2}^{1}}{\cancel{4}_{2} \times 1}$$

$$= \frac{1 \times 1}{2 \times 1}$$

$$= \frac{1}{2}$$

In $\frac{1}{4}$ h, Hally can paint $\frac{1}{2}$ of a face.

Method 2: The Common-Denominator Algorithm

$$\frac{1}{4} \div \frac{1}{2} = \frac{1}{4} \div \frac{2}{4}$$ ← Find an equivalent fraction with a common denominator.

$$= 1 \div 2$$ ← Divide the numerators.

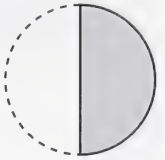
$$= \frac{1}{2}$$

In $\frac{1}{4}$ h, Hally can paint $\frac{1}{2}$ of a face.

Note: Pictures may help you visualize the situation.

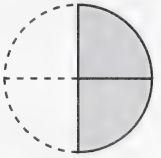
This diagram shows the time available. It is 1 fourth of an hour.

This diagram shows the time Hally requires to paint a face. It is 1 half of an hour.



The expression $\frac{1}{4} \div \frac{1}{2}$ can mean, "**How many groups** of 1 half are there in 1 fourth?"

Because the fractions do not have common denominators, 1 half must be renamed 2 fourths.



Ask yourself, "**How many groups** of 2 fourths are there in 1 fourth?"

Since the divisor 2 fourths is greater than the dividend 1 fourth, there will be fewer than 1 group.

From the diagram you can see that there is $\frac{1}{2}$ **of a group** of 2 fourths in 1 fourth.

In $\frac{1}{4}$ h, Hally can paint $\frac{1}{2}$ of a face.

Example 3

Mr. Robertson gives music lessons. If each lesson takes $\frac{1}{2}$ h, how many lessons can he give in $\frac{3}{4}$ h?

Solution

Method 1: The Reciprocal Algorithm

$$\frac{3}{4} \div \frac{1}{2} = \frac{3}{4} \times \frac{2}{1}$$ ← Multiply the dividend by the reciprocal of the divisor.

$$= \frac{3 \times \overset{1}{\cancel{2}}}{\underset{2}{\cancel{4}} \times 1}$$

$$= \frac{3 \times 1}{2 \times 1}$$

$$= \frac{3}{2}$$

$$= 1\frac{1}{2}$$

In $\frac{3}{4}$ h, Mr. Robertson can give $1\frac{1}{2}$ lessons.

Method 2: The Common-Denominator Algorithm

$$\frac{3}{4} \div \frac{1}{2} = \frac{3}{4} \div \frac{2}{4}$$ ← Find an equivalent fraction with a common denominator.

$$= 3 \div 2$$ ← Divide the numerators.

$$= \frac{3}{2}$$

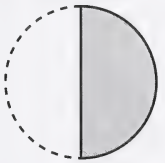
$$= 1\frac{1}{2}$$

In $\frac{3}{4}$ h, Mr. Robertson can give $1\frac{1}{2}$ lessons.

Note: Pictures may help you visualize the situation.

This diagram shows the time available for lessons. It is 3 fourths of an hour.

This diagram shows the time required for 1 lesson. It is 1 half of an hour.



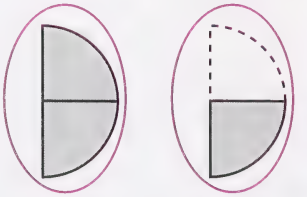
The expression $\frac{3}{4} \div \frac{1}{2}$ can mean, "**How many groups** of 1 half are there in 3 fourths?"

Because the fractions do not have a common denominator, the fraction 1 half must be renamed 2 fourths.

Ask yourself, "**How many groups** of 2 fourths are there in 3 fourths?"

Since the divisor 2 fourths is less than the dividend 3 fourths, there will be more than 1 group.

From the diagram you can see that there are $\mathbf{1\frac{1}{2}}$ **groups** of 2 fourths in 3 fourths.



In $\frac{3}{4}$ h, Mr. Robertson can give $1\frac{1}{2}$ lessons.

Use either the reciprocal algorithm or the common-denominator algorithm to solve questions 7 and 8.

7. There is $\frac{5}{6}$ of a cake on a table. How many servings of each of the following sizes can be made from the part of the cake that is on the table?

a. $\frac{1}{6}$ of a cake

b. $\frac{1}{3}$ of a cake

c. $\frac{1}{4}$ of a cake

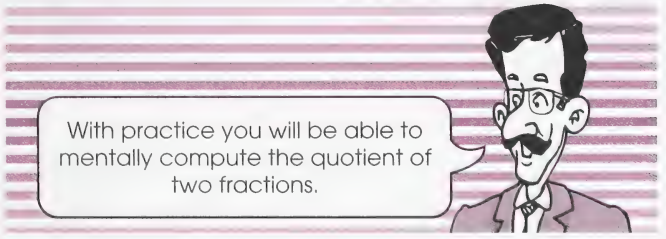
8. In the summer, Roger's father commutes to the office from his cottage. The family car uses $\frac{1}{4}$ of a tank of gas to travel from the cottage to the office.

How many trips can Roger's father make between the cottage and the office with each of the following amounts of gas?

a. $\frac{3}{4}$ of a tank **b.** $\frac{1}{8}$ of a tank **c.** $\frac{1}{2}$ of a tank

Note: You considered question 8.a. at the beginning of this activity.

Check your answers by turning to the Appendix.



When you divide fractions mentally, you may use either the common-denominator method or the reciprocal method. Choose the method that is easier to perform mentally.

Example 4

$\therefore \frac{2}{3} \div \frac{1}{3} = 2$

Example 5

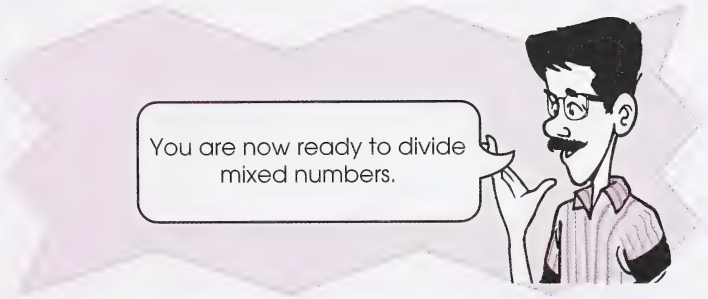
$\therefore \frac{2}{5} \div \frac{1}{2} = \frac{4}{5}$

9. Mentally compute the quotient of each of the following expressions. Use either the common-denominator method or the reciprocal method.

a. $\frac{5}{8} \div \frac{1}{8}$	**b.** $\frac{1}{3} \div \frac{2}{3}$	**c.** $\frac{7}{12} \div \frac{5}{12}$
d. $\frac{2}{3} \div 2$	**e.** $\frac{5}{6} \div 5$	**f.** $\frac{4}{5} \div 2$
g. $\frac{3}{5} \div \frac{1}{2}$	**h.** $\frac{1}{2} \div \frac{1}{4}$	**i.** $\frac{2}{3} \div \frac{1}{6}$

Check your answers by turning to the Appendix.

Dividing Mixed Numbers



Dividing mixed numbers is similar to dividing fractions. You may use the reciprocal algorithm or the common-denominator algorithm.

Example

Hoi feeds the chickens $3\frac{1}{3}$ pails of grain. If each feeder holds $1\frac{2}{3}$ pails of grain, how many feeders does Hoi fill?

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Solution

Method 1: The Reciprocal Algorithm

$$3\frac{1}{3} \div 1\frac{2}{3} = \frac{10}{3} \div \frac{5}{3}$$ ← Change mixed numbers to improper fractions.

$$= \frac{10}{3} \times \frac{3}{5}$$ ← Multiply the dividend by the reciprocal of the divisor.

$$= \frac{\overset{2}{\cancel{10}} \times \overset{1}{\cancel{3}}}{\underset{1}{\cancel{3}} \times \underset{1}{\cancel{5}}}$$

$$= \frac{2 \times 1}{1 \times 1}$$

$$= \frac{2}{1}$$

$$= 2$$

Hoi fills 2 feeders.

Method 2: The Common-Denominator Algorithm

$$3\frac{1}{3} \div 1\frac{2}{3} = \frac{10}{3} \div \frac{5}{3}$$ ← Change mixed numbers to improper fractions.

$$= 10 \div 5$$ ← Divide the numerators (there is a common denominator).

$$= 2$$

Hoi fills 2 feeders.

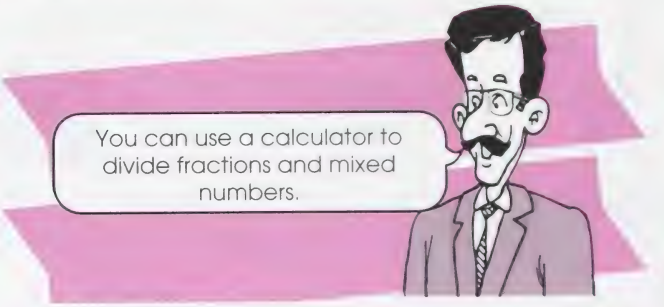
10. Evaluate each of the following expressions.

a. $2\frac{1}{2} \div \frac{5}{8}$ **b.** $6\frac{1}{2} \div 1\frac{3}{4}$ **c.** $8\frac{2}{3} \div 1\frac{1}{3}$

11. Orville is laying new tiles in his kitchen. If it takes him $1\frac{1}{4}$ minutes to glue down one tile, how many tiles can he glue down in $7\frac{1}{2}$ minutes?

Check your answers by turning to the Appendix.

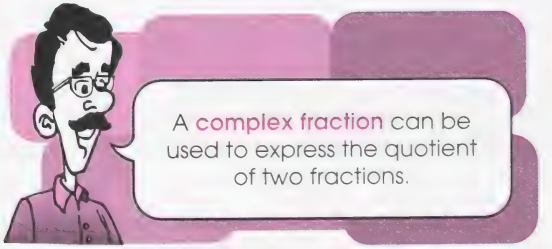
Using a Calculator



12. Find the puzzle entitled "How's Business?" Either photocopy or pull out the page. Then complete the puzzle.

13. Find the puzzle entitled "Bingo" in the Appendix. Either photocopy or pull out the page and complete the puzzle.

Check your answers by turning to the Appendix.



A complex fraction has a fraction in the numerator and/or in the denominator.

For example, $\frac{\frac{1}{2}}{\frac{5}{6}}$ is a complex fraction. It means $\frac{1}{2} \div \frac{5}{6}$.

Complex fractions can be simplified through division.

Example

Simplify the expression $\frac{\frac{1}{2}}{\frac{5}{6}}$.

Solution

Method 1: The Reciprocal Algorithm

$$\frac{\frac{1}{2}}{\frac{5}{6}} = \frac{1}{2} \div \frac{5}{6}$$ ← Rewrite the question using the ÷ sign.

$$= \frac{1}{2} \times \frac{6}{5}$$ ← Multiply the dividend by the reciprocal of the divisor.

$$= \frac{1 \times \overset{3}{\cancel{6}}}{\underset{1}{\cancel{2}} \times 5}$$

$$= \frac{1 \times 3}{1 \times 5}$$

$$= \frac{3}{5}$$

Method 2: The Common-Denominator Algorithm

$$\frac{\frac{1}{2}}{\frac{5}{6}} = \frac{1}{2} \div \frac{5}{6}$$ ← Rewrite the question using the ÷ sign.

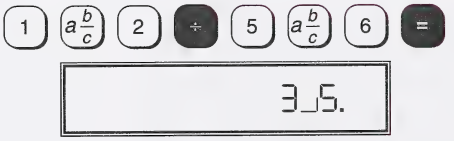
$$= \frac{3}{6} \div \frac{5}{6}$$ ← Find an equivalent fraction with a common denominator.

$$= 3 \div 5$$ ← Divide the numerators.

$$= \frac{3}{5}$$

Method 3: The Calculator Method

Press the following key sequence.



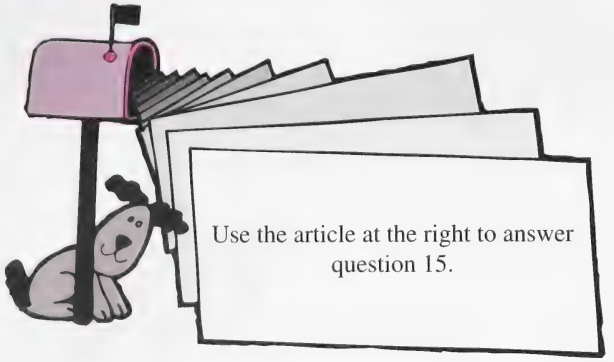
14. Simplify each of the following complex fractions.

a. $\frac{\frac{2}{7}}{\frac{5}{7}}$ **b.** $\frac{\frac{1}{3}}{\frac{3}{4}}$ **c.** $\frac{\frac{3}{4}}{\frac{1}{2}}$

Check your answers by turning to the Appendix.

Now Try This

Use a problem-solving strategy to answer each of the following questions.



15. **a.** Which animal won the race? Which animal came in second? Which animal came in third? Which animal came in last?

b. Which animal ran the fastest? Which animal ran the second fastest? Which animal ran the third fastest? Which animal ran the slowest?

The Animal Race

QUADRUPEDIA GAZETTE

Section 3

SPORTS

Race for Four-Legged Championship

The finals of the 1-km race for the championship of the kingdom of Quadrupedia were held yesterday. Five animals entered the race: a bear, a giraffe, a rabbit, a dog, and a monkey. Dr. Do A. Little gave the signal to start the race.

The bear started right at the signal. It took him $\frac{1}{2}$ min longer to run the kilometre than the giraffe.

The giraffe was daydreaming, so he started $\frac{5}{8}$ min after the bear. He ran the kilometre in $1\frac{3}{4}$ min.

The monkey ran twice as fast as the bear. He finished the race $\frac{1}{4}$ min before the giraffe.

The rabbit started $\frac{1}{3}$ min before the monkey and finished $\frac{1}{6}$ min before the giraffe.

The dog started $\frac{5}{12}$ min before the rabbit. He finished the race $1\frac{3}{4}$ min after the start of the race.

After the race the gold championship cup was awarded to the winner.

[1]

[1] "Quadrupedia Gazette." Reprinted by permission from *SRA Mathematics Learning System* copyright 1974 by International Business Machines Corporation.

16. Fran has six coins. One-third of her coins are dimes. If the dimes are one-fourth of the value of the coins, what coins does Fran have?

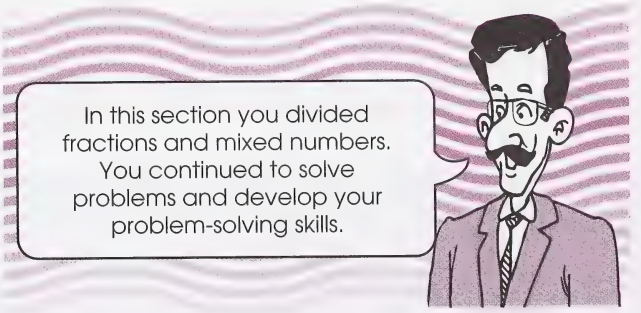
Check your answers by turning to the Appendix.

Use a problem-solving strategy to answer question 17.

17. This figure was made with 6 squares.

Rearrange the squares to make a figure with the greatest possible perimeter.

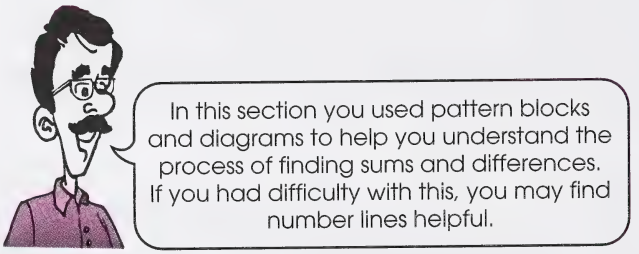
Check your answer by turning to the Appendix.



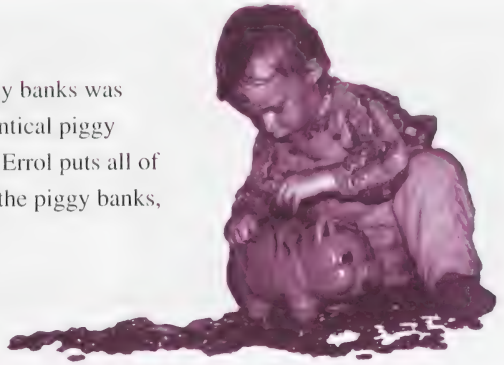
Follow-up Activities

If you had difficulties understanding the concepts and skills in the activities, it is recommended that you do the Extra Help. If you have a clear understanding of the concepts and skills, it is recommended that you do the Enrichment. You may decide to do both.

Extra Help



Example 1



One of Errol's piggy banks was $\frac{1}{4}$ full. Another identical piggy bank was $\frac{1}{2}$ full. If Errol puts all of the coins in one of the piggy banks, how full will it be?

Solution

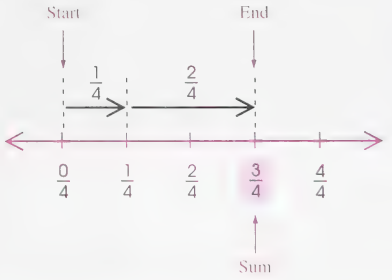
$$\frac{1}{4}+\frac{1}{2}=\frac{1}{4}+\frac{2}{4}$$ ← Find equivalent fractions with a common denominator.

$$=\frac{1+2}{4}$$ ← Add the numerators; keep the common denominator.

$$=\frac{3}{4}$$

The piggy bank will be $\frac{3}{4}$ full.

Note: A number line may help you visualize the situation.



Example 2

Suki completed $\frac{7}{8}$ of a novel. Ria read $\frac{3}{4}$ of the same novel. How much more did Suki read than Ria?

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Solution

$$\frac{7}{8}-\frac{3}{4}=\frac{7}{8}-\frac{6}{8}$$ ← Find equivalent fractions with a common denominator.

$$=\frac{7-6}{8}$$ ← Subtract the numerators; keep the common denominator.

$$=\frac{1}{8}$$

Suki read $\frac{1}{8}$ of the novel more than Ria.

Note: A number line may help you visualize the situation.

Ask yourself, "How much more did Suki read than Ria?" In other words, "What is the change from $\frac{6}{8}$ to $\frac{7}{8}$?"

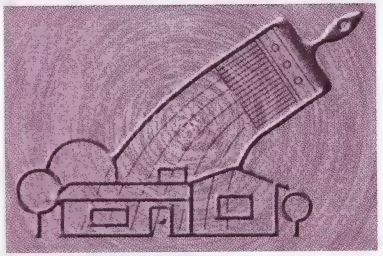
The number line shows that Suki read $\frac{1}{8}$ of a novel more than Ria.

Solve the following addition and subtraction problems. Use number lines to illustrate the answers.

1. Alvin painted $\frac{1}{3}$ of the house on Monday and $\frac{1}{2}$ of it on Wednesday.

a. What fraction of the house was painted during these two days?

b. How much more of the house did Alvin paint on Wednesday than on Monday?



2. A youth group held a bottle drive and a car wash to raise money for a camp out. From the bottle drive, the group earned $\frac{1}{4}$ of the money they needed. From the car wash, they earned $\frac{1}{2}$ of the money they needed.

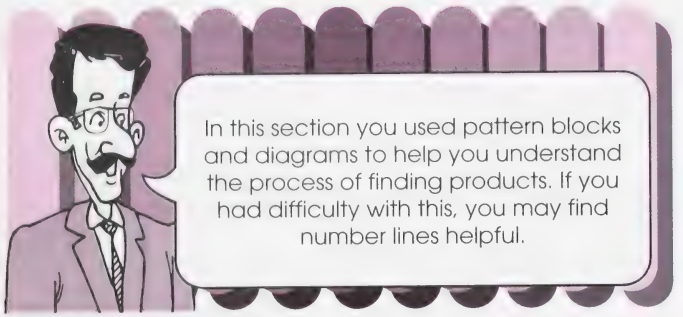
PHOTO SEARCH LTD.

a. How much of the needed money did the youth group earn altogether from the two fund-raisers?

b. How much of the money still needs to be raised?

Check your answers by turning to the Appendix.

If you have access to the software *Understanding Fractions* from the series *Understanding Math*, use it for extra help with adding and subtracting fractions.



Example 3

Joshua has 2 cats. Each day he gives $\frac{2}{3}$ of a can of food to each of his cats. How much cat food does Joshua use each day?

Solution

$$2 \times \frac{2}{3} = \frac{2}{1} \times \frac{2}{3} \quad \leftarrow \text{Change the whole number to a fraction.}$$

$$= \frac{2 \times 2}{1 \times 3} \quad \leftarrow \text{Multiply the numerators.}$$
$$\leftarrow \text{Multiply the denominators.}$$

$$= \frac{4}{3}$$

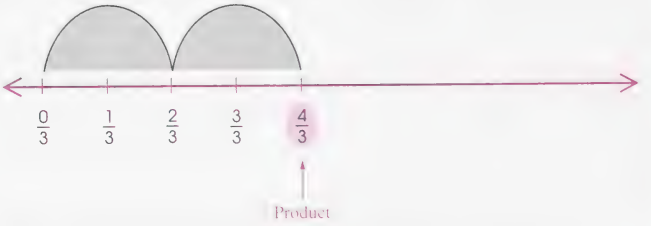
$$= 1\frac{1}{3}$$

Joshua uses $1\frac{1}{3}$ cans of cat food each day.

Note: A number line may help you visualize the situation.

Multiplication is repeated addition. Ask yourself, "2 groups of 2 thirds is **how much**?"

Show the two groups with 2 loops.



The number line shows that 2 groups of 2 thirds is **4 thirds**.

Example 4

Chor had $\frac{3}{4}$ of a jug of lemonade at his party. If his guests drank $\frac{1}{2}$ of this portion, what fraction of the entire jug did the guests drink?

Solution

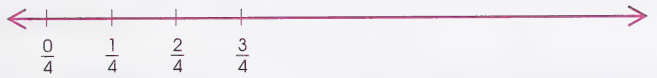
$$\frac{1}{2}\times\frac{3}{4}=\frac{1\times3}{2\times4}$$ ← Multiply the numerators. ← Multiply the denominators.

$$=\frac{3}{8}$$

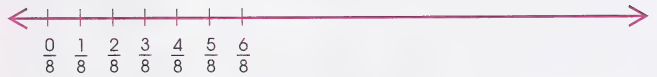
Chor's guests drank $\frac{3}{8}$ of the entire jug of lemonade.

Note: A number line may help you visualize the situation.

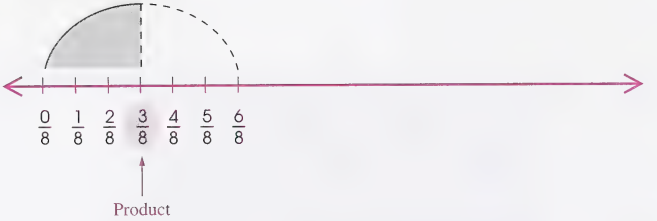
Ask yourself, "In 3 fourths, there is 1 of 2 equal groups of **how much**?"



To answer this question you need to rename 3 fourths as 6 eighths.



Ask yourself, "In six eighths, there is 1 of 2 equal groups of how much?"



The number line shows that in 6 eighths there is 1 of 2 equal groups of **3 eighths**.

3. Solve the following multiplication problems. Use number lines to illustrate the answers.

a. Louis practises playing the tuba for $\frac{3}{4}$ h each day. How long did he practice in 5 days?

b. It took Lucinda $\frac{3}{4}$ h to go from her house to the mall. She spent $\frac{2}{3}$ of that time waiting for a bus. What fraction of an hour did Lucinda wait?

c. Steve ran a race in $\frac{5}{6}$ h last year. This year he ran the race in $\frac{1}{2}$ of this time. In what fraction of an hour did he run the race this year?

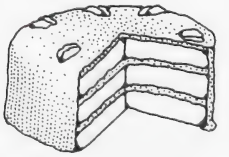
Check your answers by turning to the Appendix.

If you have access to the software *Understanding Fractions* from the series *Understanding Math*, use it for extra help with multiplying fractions.

In this section you used pattern blocks and diagrams to help you understand the process of finding quotients. If you had difficulty with this, you may find number lines helpful.

Example 5

How many people can share $\frac{3}{4}$ of a cake if each person receives $\frac{1}{4}$ of the entire cake?



Solution

Method 1: The Reciprocal Algorithm

$$\frac{3}{4} \div \frac{1}{4} = \frac{3}{4} \times \frac{4}{1}$$ ← Multiply the dividend by the reciprocal of the divisor.

$$= \frac{3 \times \overset{1}{\cancel{4}}}{\underset{1}{\cancel{4}} \times 1}$$

$$= \frac{3}{1}$$

$$= 3$$

If each person receives $\frac{1}{4}$ of the entire cake, the number of people who could share $\frac{3}{4}$ of a cake is 3.

Method 2: The Common-Denominator Algorithm

$$\frac{3}{4} \div \frac{1}{4} = 3 \div 1$$ ← Divide the numerators (there is a common denominator)

$$= 3$$

If each person receives $\frac{1}{4}$ of the entire cake, the number of people who could share $\frac{3}{4}$ of a cake is 3.

Note: A number line may help you visualize the situation.

Ask yourself, "**How many groups** of $\frac{1}{4}$ are there in $\frac{3}{4}$?"

The number line shows that there are **3 groups**.

$\therefore \frac{3}{4} \div \frac{1}{4} = 3$

Example 6

If each haircut takes $\frac{1}{2}$ h, how many haircuts can be given in $\frac{3}{4}$ h?

Solution

Method 1: The Reciprocal Algorithm

$$\frac{3}{4} \div \frac{1}{2} = \frac{3}{4} \times \frac{2}{1}$$ ← Multiply the dividend by the reciprocal of the divisor.

$$= \frac{3 \times \cancel{2}^{1}}{\cancel{4}_{2} \times 1}$$

$$= \frac{3}{2}$$

$$= 1\frac{1}{2}$$

If each haircut takes $\frac{1}{2}$ h, then the number of haircuts that can be given in $\frac{3}{4}$ h is $1\frac{1}{2}$.

Method 2: The Common-Denominator Algorithm

$$\frac{3}{4} \div \frac{1}{2} = \frac{3}{4} \div \frac{2}{4}$$ ← Find an equivalent fraction with a common denominator.

$$= 3 \div 2$$ ← Divide the numerators.

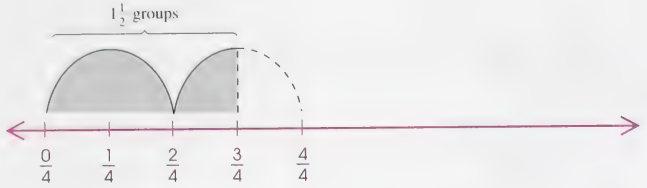
$$= \frac{3}{2}$$

$$= 1\frac{1}{2}$$

If each haircut takes $\frac{1}{2}$ h, then the number of haircuts that can be given in $\frac{3}{4}$ h $1\frac{1}{2}$.

Note: A number line may help you visualize the situation.

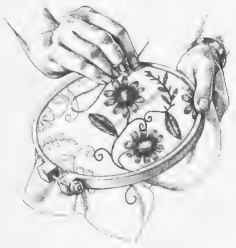
Ask yourself, "**How many groups** of 1 half are there in 3 fourths?" To answer this question, rename $\frac{1}{2}$ as $\frac{2}{4}$. Ask yourself, "How many groups of 2 fourths are there in 3 fourths?"



There are $\mathbf{1\frac{1}{2}}$ **groups**.

Example 7

Janice uses $\frac{7}{8}$ of a skein of thread to embroider one flower. How many flowers can she embroider from $\frac{3}{4}$ of a skein of thread?



Solution

Method 1: The Reciprocal Algorithm

$$\frac{3}{4} \div \frac{7}{8} = \frac{3}{4} \times \frac{8}{7}$$ ← Multiply the dividend by the reciprocal of the divisor

$$= \frac{3 \times \overset{2}{\cancel{8}}}{\underset{1}{\cancel{4}} \times 7}$$

$$= \frac{6}{7}$$

Janice can embroider $\frac{6}{7}$ of a flower.

Method 2: The Common-Denominator Algorithm

$$\frac{3}{4} \div \frac{7}{8} = \frac{6}{8} \div \frac{7}{8}$$ ← Write equivalent fractions with a common denominator

$$= 6 \div 7$$ ← Divide the numerators.

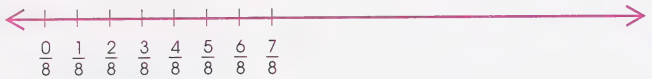
$$= \frac{6}{7}$$

Janice can embroider $\frac{6}{7}$ of a flower.

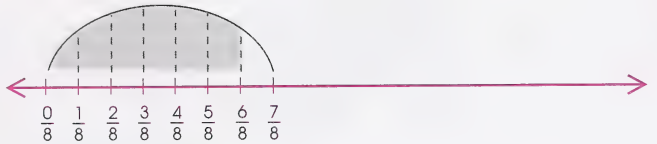
Note: A number line may help you visualize the situation.

Ask yourself, "How many groups of $\frac{7}{8}$ are there in $\frac{3}{4}$?"

To answer this question, you need to rename $\frac{3}{4}$ as $\frac{6}{8}$.



Ask yourself, "**How many groups** of $\frac{7}{8}$ are there in $\frac{6}{8}$?"



There is $\frac{6}{7}$ **of a group**.

4. Solve the following division problems. Use number lines to illustrate the answers.

There is $\frac{1}{3}$ of a pie in the refrigerator.

a. How many $\frac{1}{6}$-piece servings are in this portion of pie?

b. How many $\frac{1}{4}$-piece servings are in the pie?

c. How many $\frac{1}{2}$-piece servings are in the pie?

Check your answers by turning to the Appendix.

If you have access to the software *Understanding Fractions* from the series *Understanding Math*, use it for extra help with dividing fractions.

Enrichment

Squares like the following are called **addition magic squares**.

In an addition magic square, the sum of the numbers in each row, column, or diagonal is the same.

4	9	2
3	5	7
8	1	6

In this addition magic square each row, column, and diagonal has a sum of 15.

1. Copy and complete each of the following addition magic squares.

a.

$3\frac{1}{3}$	$1\frac{2}{3}$	4
	$4\frac{1}{3}$	

b.

1		$\frac{1}{2}$
	$1\frac{1}{4}$	
		$1\frac{1}{2}$

Check your answers by turning to the Appendix.

2. Copy and complete each of the following subtraction magic squares.

a.

$\frac{2}{3}$	$\frac{1}{3}$	$1\frac{1}{3}$
	$1\frac{2}{3}$	

b.

		1
	$1\frac{1}{4}$	$1\frac{3}{4}$
$1\frac{1}{2}$		

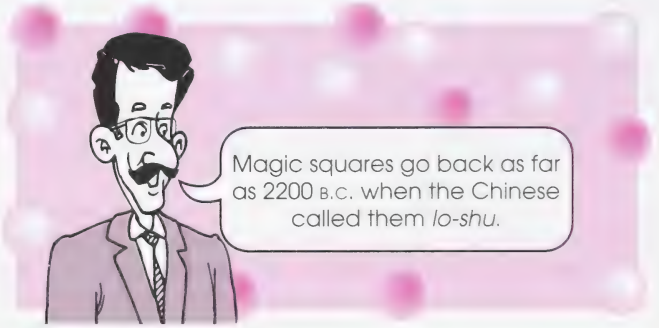
Check your answers by turning to the Appendix.

Squares like the following are called **subtraction magic squares.**

In a subtraction magic square, the sum of the two end numbers (in each row, column, or diagonal) minus the centre number (of the row, column, or diagonal) is the same.

2	1	4
3	5	7
6	9	8

In this subtraction magic square the sum of the two end numbers (in each row, column, or diagonal) minus the centre number (of the row, column, or diagonal) is 5.



Use the Internet to discover more about magic squares.

Conclusion

In this section you increased your number sense and operation sense. You added, subtracted, multiplied, and divided fractions and mixed numbers. You used models and pictures to visualize the operations. You performed the operations using paper-and-pencil methods, mental computation, and calculators.

Fractions and mixed numbers are used to describe many situations in everyday life. For example, photographers use fractions to describe shutter speeds.

With a shutter speed of 2, the shutter stays open for $\frac{1}{2}$ s; with a shutter speed of 500, the shutter stays open for $\frac{1}{500}$ s. Which setting would you use to take a photo of a sunset? Which setting would you use to take a photo of a bird in flight?

Assignment

Assignment Booklet

You are now ready to complete the assignment for Section 1.

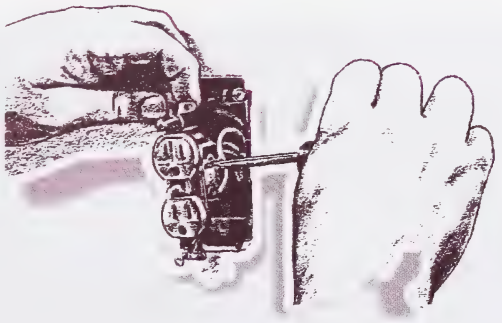
Section 2: Positive and Negative Numbers

The money to run many large companies is obtained from investors who buy stocks or shares in these companies. These stocks are sold through stock exchanges such as the Toronto Stock Exchange, the Vancouver Stock Exchange, and the Alberta Stock Exchange.

If a company makes money, or if the investors expect it to make money, the price of the company's stock usually rises. If a company loses money, or if the investors are afraid it will lose money, the price of the company's stock usually falls. The daily happenings of the stock market are published in newspapers and on the Internet. Positive numbers are used to show an increase. Negative numbers are used to show a decrease.

In this section you will investigate many situations that involve positive and negative numbers. You will graph ordered pairs of numbers. You will review operations on decimal numbers and integers. You will perform operations on positive and negative decimal numbers.

Activity 1: Number Sense



Have you ever noticed that electrical wires are different colours? Electricians use the colours to determine which wires need to be connected.

There are two kinds of electrical charges—positive charges and negative charges. If a positive charge comes together with a negative charge, the result is no charge.

As you recall from previous work with integers, two colours of counters can be used to model integers.

(+) represents +1.

(−) represents −1.

(+)(−) represents 0.

Notice that combining two different colours of counters creates a **zero pair**.

Find the two sets of cut-out counters in the Appendix of this module. Photocopy the page of learning aids. You may wish to laminate the photocopy of this page (or glue it to heavier paper) before cutting out the learning aids. The counter will be easier to handle.

If you prefer, you can use checkers, bingo chips, or even two kinds of coins.

1. Use the counters to model each of the following integers.

a. +5 **b.** −6 **c.** −3 **d.** +4

2. What does each of the following diagrams represent?

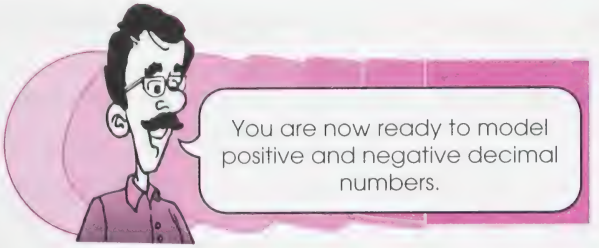
a. (+)(+)(+) (−)(−)(−)

b. (+)(+)(+)(+) (−)(−)

c. (+)(+) (−)(−)(−)

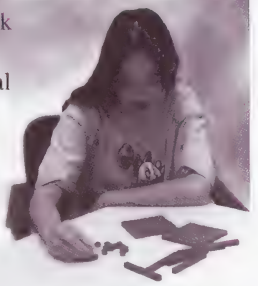
Check your answers by turning to the Appendix.

Note: Save the counters; you will need them in Module 2 and Module 3.



As you will recall from your previous work with decimal numbers, three kinds of base ten blocks can be used to represent decimal numbers—flats, longs, and small cubes.

If you use two colours of base ten blocks, positive and negative decimal numbers can be modelled.




represents +1.


represents +0.1.


represents +0.01.


represents −1.


represents −0.1.


represents −0.01.

You have combined two colours of counters to create a zero pair. You can also combine two different colours of the same kinds of base ten blocks to create a zero pair. For example, the following model represents 0.

Find the two sets of cut-out base ten blocks in the Appendix of this module. Photocopy the pages of learning aids. You may wish to colour one set. Laminate the photocopies (or glue them to heavier paper) before cutting out the learning aids. The blocks will be easier to handle.

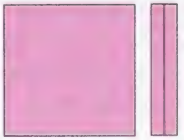
Your school or school division may have two sets of different coloured base ten blocks which you could also use.

3. Use the base ten blocks to model each of the following decimal numbers.

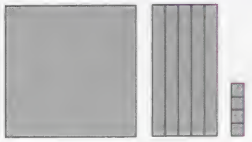
a. −0.5 **b.** +1.02 **c.** −2.24

4. What does each of the following diagrams represent?

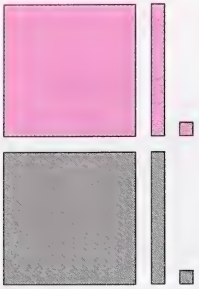
a.



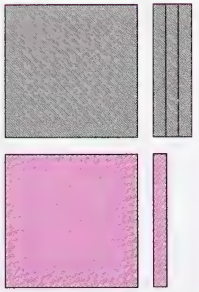
b.



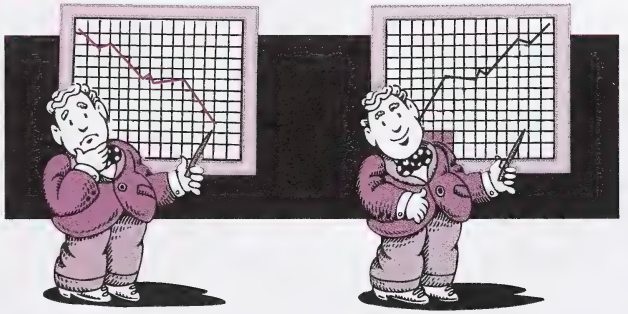
c.



d.



Check your answers by turning to the Appendix.



Accountants use colours to describe the financial position of a company.

- When accountants say that the company is in the black, they mean the company has made a profit.
- When accountants say that the company is in the red, they mean the company has incurred a debt.

Positive numbers can be used to describe profits. Negative numbers can be used to describe debts.

5. What number can be used to describe each of the following situations?

a. a debt of $975.37 **b.** a profit of $649.98

Check your answers by turning to the Appendix.

6. Positive and negative numbers are used to describe temperatures.

The following chart lists the average January temperature range for seven communities in the Atlantic provinces.

Community	High (°C)	Low (°C)
Halifax	0	−8.3
Sydney	−1.1	−9.4
St. John's	−1.1	−7.8
Goose Bay	−13.9	−22.8
St. John	−2.2	−11.1
Moncton	−3.9	−13.9
Charlottetown	−3.3	−11.7

a. Which community listed on the chart has the lowest average low temperature for January?

b. Which community listed on the chart has the highest average high temperature for January?

You may wish to explore temperatures in various Canadian communities by visiting Environmental Canada's Green Lane site at the following uniform resource locator (URL):

http://www.tor.ec.gc.ca/

7. The melting point of a substance is the temperature at which it will change from a solid to a liquid state. The following chart lists the melting point of three metals.

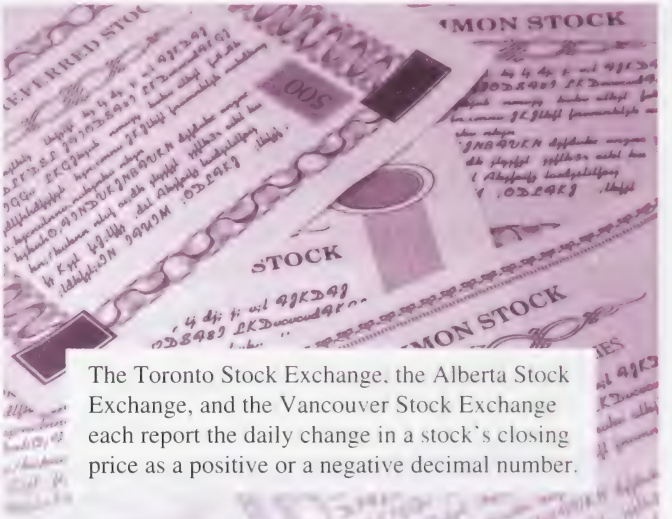
Metal	Melting Point (°C)
zinc	419.5
mercury	−38.4
silver	960.8

a. Which metal listed in the chart has the highest melting point?

b. Which metal listed on the chart has the lowest melting point?

Check your answers by turning to the Appendix.

8.



The Toronto Stock Exchange, the Alberta Stock Exchange, and the Vancouver Stock Exchange each report the daily change in a stock's closing price as a positive or a negative decimal number.

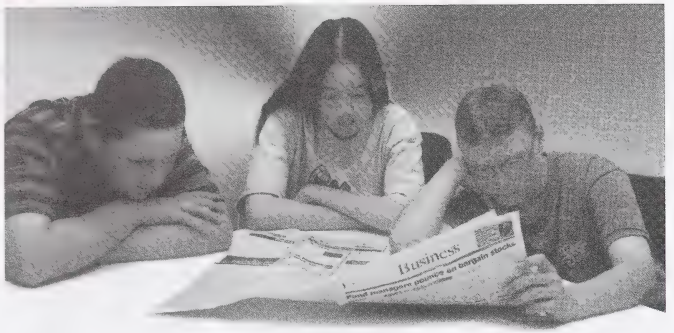
The following chart lists the change in the closing price of five stocks sold on the Toronto Stock Exchange on a given day.

Stock	Symbol	Closing Price ($)	Change ($)
Biomira	BRA	7.60	−0.35
Newalta	NAL	5.35	0.00
Nova	NVA	12.55	+0.05
Telus	T	18.75	+0.20
TransAlta	TA	14.90	−0.10

a. What stock listed on the chart had the greatest decrease?
b. What stock listed on the chart had the greatest increase?

c. What stock listed on the chart had no change in the closing price?

Check your answers by turning to the Appendix.



The business section of a large newspaper reports on the daily happenings of the stock market. You may wish to check a newspaper to discover how the prices of the stocks listed in question 8 have changed.

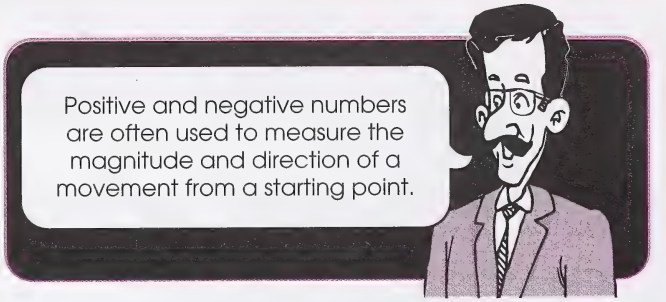
Many sites on the Internet give stock quotes. Here is the uniform resource locator (URL) of a site which you may find helpful.

http://www.telenium.ca

Simply click on "Free Canadian Quotes" and then enter the stock symbol. For example, to find the current price of TransAlta, enter the symbol TA and press "Return."

Note: If you have a colour monitor, you will notice that increases in the stock price are printed in green and decreases are printed in red.

You may wish to explore other programs or stock exchanges. Explore terms such as "stocks," "stock quotes," or "Toronto Stock Exchange."



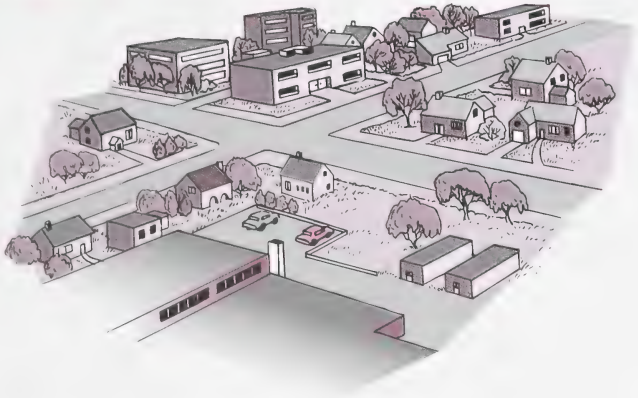
9. Copy and complete the pairs of opposites in the following chart.

Positive	Negative
up	
	left
	west
north	

10. What numbers could be used to describe each of the following situations?

a. an elevator goes up 32.5 m
b. a jogger runs west 12.8 m
c. a car backs up 50 m
d. a picture is moved right 4 cm

Check your answers by turning to the Appendix.



In many western communities, avenues run east and west; streets run north and south. The streets and avenues create a grid. The location of a building on this grid is described by two numbers: the building number and the street or avenue number.

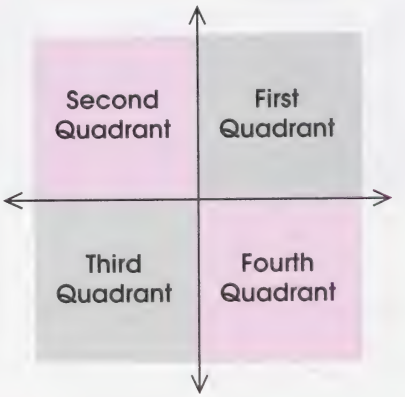
In the **Cartesian coordinate system**, the horizontal axis, or x-axis, is used to describe movements left or right of the **origin**. The vertical axis, or y-axis, is used to describe movements up or down from the origin.

The Cartesian coordinate system is a way of defining the position of a point in two-dimensional space. The origin is the point where the x-axis and the y-axis meet.

The coordinates of a point are the numbers in the ordered pair. They show the position of a point with respect to the x-axis and the y-axis.

Points may be located on the x-axis, on the y-axis, or in any of the four **quadrants**.

A quadrant is one of the four regions formed by the axes. Quadrants are numbered counter-clockwise, starting in the upper right-hand region.



Example 1

Plot the points $(-5, 2)$, $(2, -3)$, and $(-4, -1)$ on a graph.

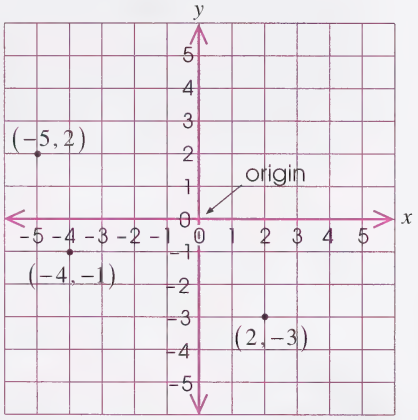
Solution

Step 1: Draw and label the x-axis and y-axis on a piece of graph paper.

Step 2: To plot the point $(-5, 2)$, begin at the origin. Count left 5 units and then up 2 units. Make a dot and label it $(-5, 2)$. **Note:** The point is in the second quadrant.

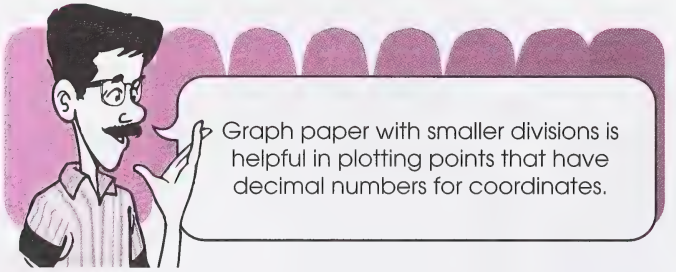
Step 3: To plot the point $(2, -3)$, begin at the origin. Count right 2 units and then down 3 units. Make a dot and label it $(2, -3)$. **Note:** The point is in the fourth quadrant.

Step 4: To plot the point $(-4, -1)$, begin at the origin. Count left 4 units and down 1 unit. Make a dot and label it $(-4, -1)$. **Note:** The point is in the third quadrant.



11. In the Appendix, find "Puzzle 1." Either photocopy or pull out the sheet and then complete the puzzle.

Check your answer by turning to the Appendix.



Example 2

Plot the points $(-2.4, 1.8)$, $(1.6, -2.3)$, and $(-1, -1.9)$ on a graph.

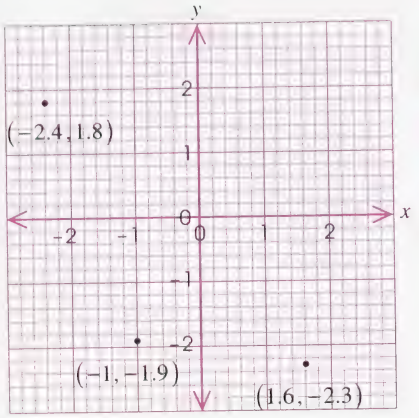
Solution

Step 1: Draw and label the x-axis and y-axis on a piece of graph paper.

Step 2: To plot the point $(-2.4, 1.8)$, begin at the origin. Count left 2.4 units and then up 1.8 units. Make a dot and label it $(-2.4, 1.8)$. **Note:** The point is in the second quadrant.

Step 3: To plot the point $(1.6, -2.3)$, begin at the origin. Count right 1.6 units and then down 2.3 units. Make a dot and label it $(1.6, -2.3)$. **Note:** The point is in the fourth quadrant.

Step 4: To plot the point $(-1, -1.9)$, begin at the origin. Count left 1 unit and then down 1.9 units. Make a dot and label it $(-1, -1.9)$. **Note:** The point is in the third quadrant.



12. Long ago astronomers made maps of the evening sky. They named constellations—groups of stars that formed outlines of objects, people, or animals.

a. In the Appendix, find "Puzzle 2." Either photocopy or pull out the sheet and then complete the puzzle.

b. Do some research to discover which constellation Puzzle 2 represents.

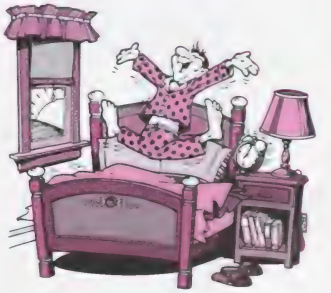
Check your answer by turning to the Appendix.

If you would like to learn more about the constellation Orion or other constellations, you may wish to use the Internet. Use the search engines to explore terms like *constellations*, *stars*, or *space*. There are several interesting, entertaining, and interactive sites.

Now Try This

Use a problem-solving strategy to answer the following question.

13. Sid's bus leaves at 08:30. Before catching the bus, Sid needs to do several things—shower and dress, make and eat breakfast, feed and walk his dog, pack his lunch, and walk to the bus stop. It takes Sid 45 min to shower and dress, 20 min to make and eat breakfast, 15 min to feed and walk his dog, 5 min to pack his lunch, and 10 min to walk to the bus stop. In order to do these activities and catch the bus, what is the latest time Sid can get up in the morning?



Check your answer by turning to the Appendix.

Did You Know?

In Section 1 you discovered that a Canadian was involved in the world's first radio broadcast. Did you know that a Canadian pioneered the first commercial radio receiver powered by alternating current?

Find and read the article entitled "The First Commercial Radio Receiver Powered by Alternating Current" in the Appendix.

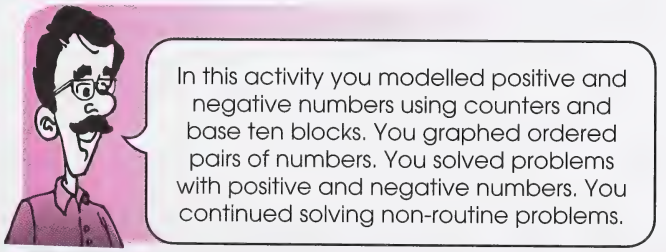
14. a. Who invented the first radio powered by electricity rather than a battery?

b. In what ways was Rogers a successful businessman?

Check your answers by turning to the Appendix.

Use the Internet to discover what early radios looked like. This is the uniform resource locator (URL) of a site you may find helpful:

http://www.alpcom.it/hamradio/ancient.html

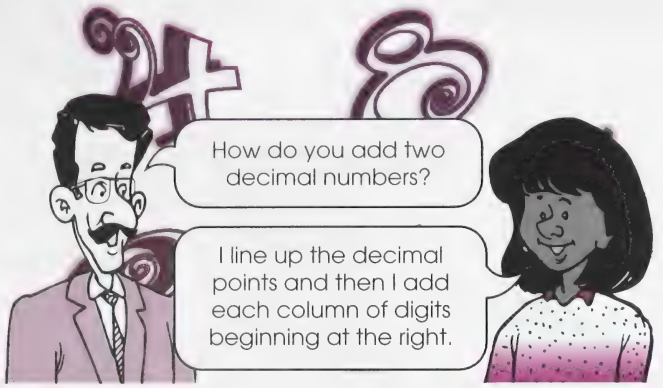


Activity 2: Adding and Subtracting

Learning mathematics is like constructing a building. New skills are added to previously developed skills just as walls are built on a foundation.

You already know how to add and subtract integers. You also know how to add and subtract decimal numbers. In this activity you will review what you already know. You will then build on these skills as you add and subtract positive and negative decimal numbers.

What You Already Know About Decimal Numbers



When you add decimal numbers, regrouping is sometimes required.

Example 1

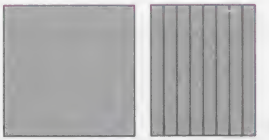
Evaluate the expression $1.8 + 0.3$.

Solution

$$\begin{array}{r} {\scriptstyle 1} \\ 1.8 \\ +\ 0.3 \\ \hline 2.1 \end{array}$$

← Regrouping may be done mentally.

Note: You can use base ten blocks to illustrate this example.

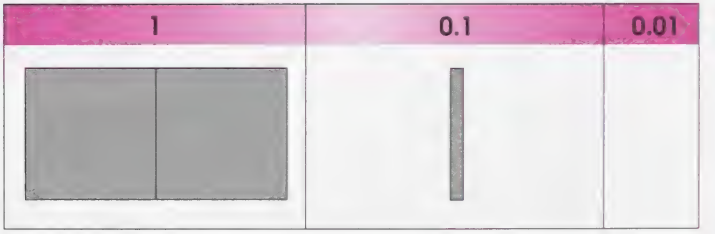


represents 1.8.

represents 0.3.

Step 1: Combine the models of 1.8 and 0.3.

Step 2: Trade 10 longs for 1 flat.



The result is 2 flats and 1 long. This represents 2.1.

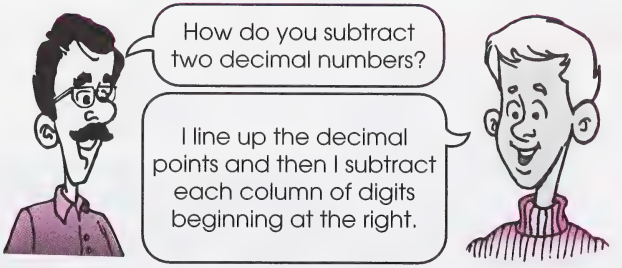
1. Find the following sums. Use base ten blocks to illustrate each sum.

   a. $1.12 + 1.35$ **b.** $1.9 + 0.6$

2. Rachel bought a pair of jeans for $35.99 and a pair of socks for $2.49. What was the total cost of her purchases (without tax)?

3. A speedskater skated two laps of the ice rink. The first lap was skated in 42.76 s. The second lap was skated in 43.18 s. What was the skater's time for the two laps?

Check your answers by turning to the Appendix.



When you subtract decimal numbers, regrouping is sometimes required.

Example 2

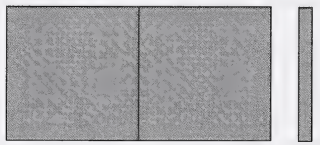
Evaluate the expression $2.1 - 1.3$.

Solution

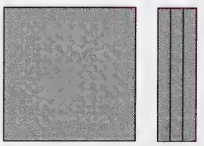
$$\begin{array}{r} {\scriptstyle 1\ \ 11} \\ 2.\cancel{1}\,\cancel{1} \\ -\ 1.3 \\ \hline 0.8 \end{array}$$

Regrouping may be done mentally.

Note: You can use base ten blocks to illustrate this example.



represents 2.1.

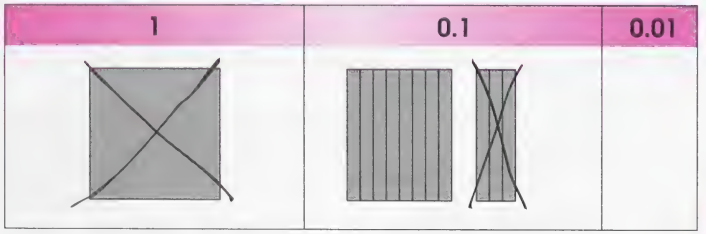


represents 1.3.

Step 1: You cannot remove the model of 1.3 from 2.1. Therefore, in the model of 2.1, trade 1 flat for 10 longs.

Step 2: Remove 1.3 from 2.1.

The ✗s represent base ten blocks that have been removed.



The result is 8 longs. This represents 0.8.

4. Find the following differences. Use base ten blocks to illustrate each difference.

a. $2.18 - 1.05$ **b.** $1.24 - 0.15$

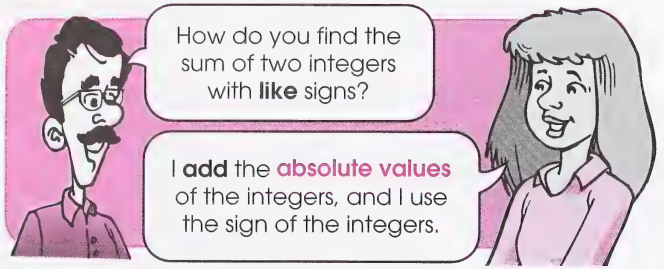
5. Francine bought a coat on sale for $69.98. The regular price of the coat was $124.99. By how much was the coat reduced?

6. The Pyramids of Giza in Egypt are considered to be one of the Seven Wonders of the World. The Great Pyramid was originally about 146.7 m tall. The loss of the topmost stones reduced the pyramid's height by approximately 9.4 m. What is the height of the Great Pyramid now?

Check your answers by turning to the Appendix.

You may wish to use one of the search engines on the Internet to find out more about the Pyramids of Giza. Try entering terms such as *pyramids*, *Giza*, or *Egypt*.

What You Already Know About Integers



The absolute value of an integer is the size or magnitude of the number without regard to the sign.

For example, the absolute value of $+2$ is 2. The absolute value of -2 is also 2.

Example 1

Evaluate the expression $(+5)+(+3)$.

Solution

$$(+5)+(+3)=+(5+3) \quad \textbf{or} \quad \begin{array}{r} +5 \\ +\ (+3) \\ \hline +(5+3)=+8 \end{array}$$
$$=+8$$

The answer may also be stated as 8.

Note: You can use counters to illustrate this example.

 represents $+5$.

 represents $+3$.

Combine the models of $+5$ and $+3$.

The result is 8 positive counters. This represents $+8$.

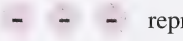
Example 2

Evaluate the expression $(-3)+(-1)$.

Solution

$$(-3)+(-1)=-(3+1) \quad \textbf{or} \quad \begin{array}{r} -3 \\ +\ (-1) \\ \hline -(3+1)=-4 \end{array}$$
$$=-4$$

Note: You can use counters to illustrate this example.

 represents -3.

 represents -1.

Combine the models of -3 and -1.

The result is 4 negative counters. This represents -4.

7. Find the following sums. Use counters to illustrate your answers.

a. $(+8)+(+5)$

b. $(-3)+(-4)$

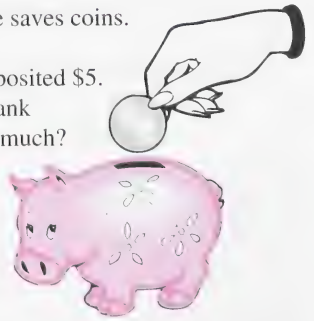
c.
$$\begin{array}{r} (+2) \\ +\ (+1) \\ \hline \end{array}$$

d.
$$\begin{array}{r} (-5) \\ +\ (-3) \\ \hline \end{array}$$

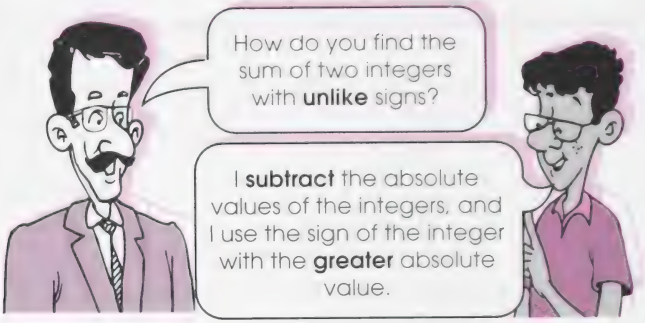
8. Rita has a piggy bank in which she saves coins.

a. Rita deposited \$3 and later deposited \$5. Did the total in Rita's piggy bank increase or decrease? By how much?

b. Rita withdrew \$2 and later withdrew \$8. Did the total in Rita's piggy bank increase or decrease? By how much?



Check your answers by turning to the Appendix.



Example 3

Evaluate the expression $(+4)+(-5)$.

Solution

$$(+4)+(-5)=-(5-4) \quad \textbf{or} \quad \begin{array}{r} +4 \\ +\ (-5) \\ \hline -(5-4)=-1 \end{array}$$
$$=-1$$

Note: You can use counters to illustrate this example.

 represents $+4$.

 represents -5.

Step 1: Combine the models of $+4$ and -5.

Step 2: Identify and remove any zero pairs. (This will not change the value of the expression.)

The slashes indicate that opposites cancel each other.

The result is 1 negative counter. This represents -1.

Example 4

Evaluate the expression $(-3)+(+5)$.

Solution

$$(-3)+(+5)=+(5-3) \quad \textbf{or} \quad \begin{array}{r} -3 \\ +\ (+5) \\ \hline +(5-3)=+2 \end{array}$$
$$=+2$$

Note: You can use counters to illustrate this example.

represents -3.

represents $+5$.

Step 1: Combine the models of -3 and $+5$.

Step 2: Identify and remove any zero pairs. (This will not change the value of the expression.)

The slashes indicate that opposites cancel each other.

The result is 2 positive counters. This represents $+2$.

9. Find the following sums. Use counters to illustrate each sum.

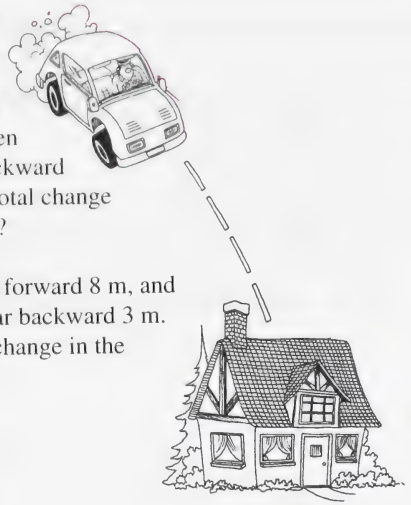
a. $(+5)+(-4)$

b. $(+6)+(-8)$

c. $\begin{array}{r} (+1) \\ +\ (-5) \\ \hline \end{array}$

d. $\begin{array}{r} (-8) \\ +\ (+9) \\ \hline \end{array}$

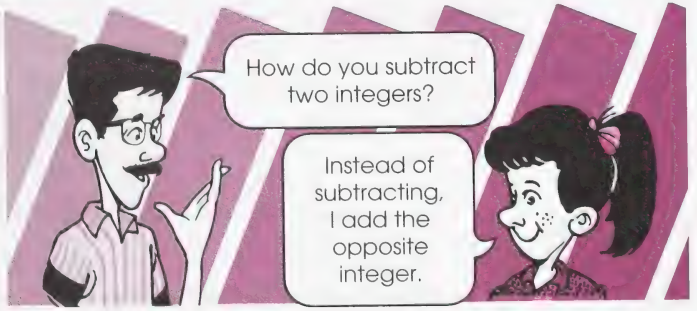
10. Frank parks his car in a long driveway.



a. Frank drives the car forward 3 m, and then he drives the car backward 4 m. What was the total change in the car's position?

b. Frank drives the car forward 8 m, and then he drives the car backward 3 m. What was the total change in the car's position?

Check your answers by turning to the Appendix.



Example 5

Evaluate the expression $(-5)-(-2)$. **Hint:** -2 and $+2$ are opposites.

Solution

$$(-5)-(-2)=(-5)+(+2)$$
$$=-(5-2)$$
$$=-3$$

or

$$\begin{array}{r} -5 \\ -\ (-2) \\ \hline \end{array} = \begin{array}{r} -5 \\ +\ (+2) \\ \hline -(5-2)=-3 \end{array}$$

Note: You can use counters to illustrate this example.

represents -5.

represents -2.

Remove the model of -2 from -5.

The ✗s indicate -2 has been subtracted.

The result is 3 negative counters. This represents -3.

Example 6

Evaluate the expression $(+2)-(-1)$. **Hint:** -1 and $+1$ are opposites.

Solution

$$(+2)-(-1)=(+2)+(+1)$$
$$=+(2+1)$$
$$=+3$$

or

$$\begin{array}{r} +2 \\ -\ (-1) \\ \hline \end{array} \quad = \quad \begin{array}{r} +2 \\ +\ (+1) \\ \hline +(2+1)=+3 \end{array}$$

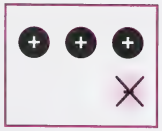
Note: You can use counters to illustrate this example.

⊕ ⊕ represents $+2$.

⊖ represents -1.

Step 1: You cannot remove the model of -1 from $+2$. Therefore, to the model of $+2$, add a zero pair. (Adding a zero pair will not change the value of $+2$.)

Step 2: Remove -1 from $+2$.



The result is 3 positive counters. This represents $+3$.

11. Find each of the following differences. Use counters to illustrate each difference.

a. $(+8)-(+3)$ **b.** $(+5)-(+6)$ **c.** $(-2)-(+3)$

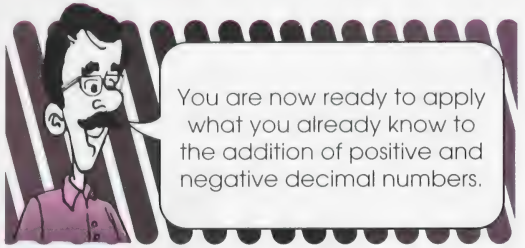
d. $\begin{array}{r} (+5) \\ -\ (-4) \\ \hline \end{array}$ **e.** $\begin{array}{r} (-8) \\ -\ (-3) \\ \hline \end{array}$ **f.** $\begin{array}{r} (-5) \\ -\ (-7) \\ \hline \end{array}$

12. A stock's opening price was \$8. Its closing price that day was \$7. What was the change in the price of the stock?

13. The temperature inside Jett's house is 20°C. The temperature outside is -8°C. What change in temperature will Jett experience when he goes out of the house?

Check your answers by turning to the Appendix.

Putting It All Together



Example 1

Evaluate the expression $(-1.24)+(-1.13)$.

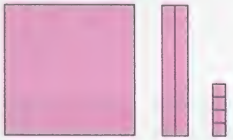
Solution

$$(-1.24)+(-1.13)=-(1.24+1.13)$$
$$=-2.37$$

or

$$\begin{array}{r} -1.24 \\ +\ (-1.13) \\ \hline -(1.24+1.13)=-2.37 \end{array}$$

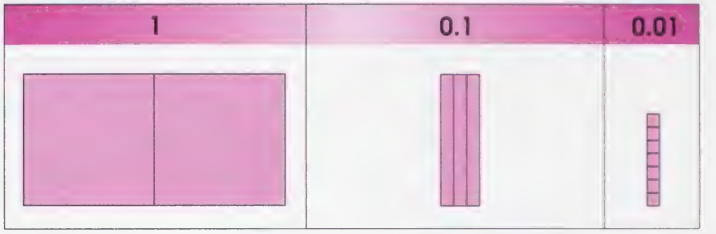
Note: You can use base ten blocks to illustrate this example.



represents -1.24.

represents -1.13.

Combine the models of -1.24 and -1.13.



The result is 2 flats, 3 longs, and 7 small cubes. All the blocks are negative. This represents -2.37.

Example 2

Evaluate the expression $(+1.83)+(-0.41)$.

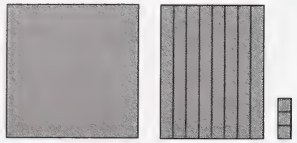
Solution

$$(+1.83)+(-0.41)=+(1.83-0.41)$$
$$=+1.42$$

or

$$\begin{array}{r} +1.83 \\ +\ (-0.41) \\ \hline +(1.83-0.41)=+1.42 \end{array}$$

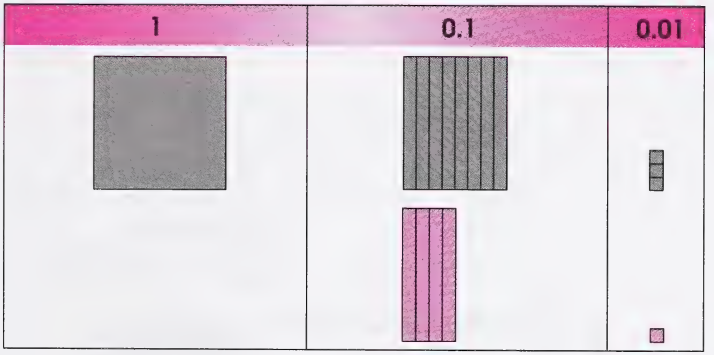
Note: You can use base ten blocks to illustrate this example.



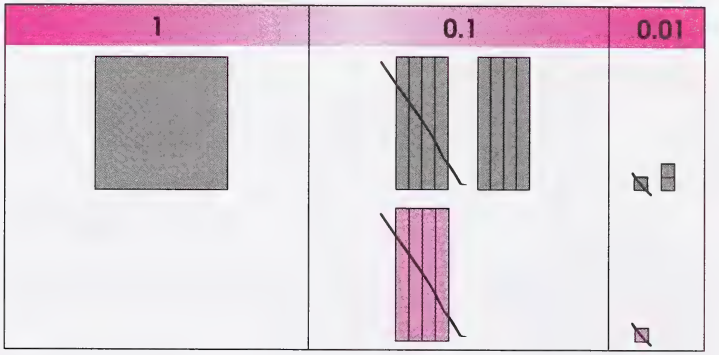
represents $+1.83$.

represents -0.41.

Step 1: Combine the models of $+1.83$ and -0.41.



Step 2: Remove any zero pairs. (This will not change the value of the expression.)



The result is 1 flat, 4 longs, and 2 small cubes. All the blocks are positive. This represents $+1.42$.

Example 3

Evaluate the expression $(-1.2)+(+2.1)$.

Solution

$$(-1.2)+(+2.1)=+(2.1-1.2)$$
$$=+0.9$$

or

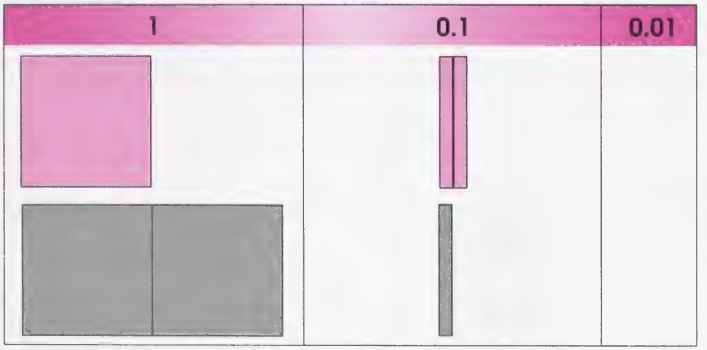
$$\begin{array}{r} -1.2 \\ +\ (2.1) \\ \hline +(2.1-1.2)=+0.9 \end{array}$$

Note: You can use base ten blocks to illustrate this example.

represents -1.2.

represents $+2.1$.

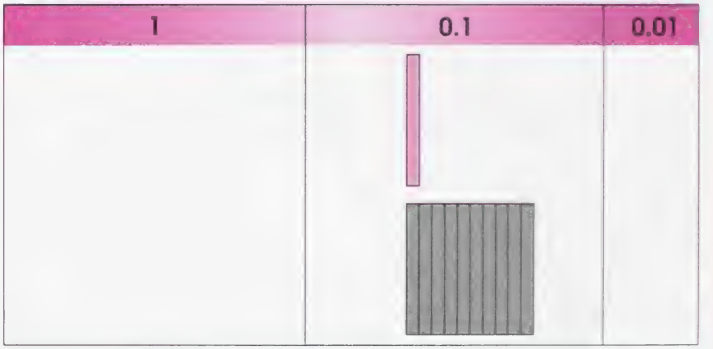
Step 1: Combine the models of -1.2 and $+2.1$.



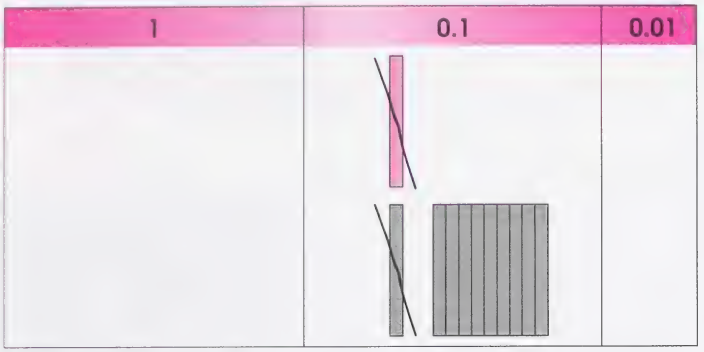
Step 2: Remove any zero pairs. (This will not change the value of the expression.)

The result is 1 positive flat and 1 negative long. This is **not** the sum. (The blocks must be of all one colour to represent decimal numbers.)

Step 3: Trade the positive flat for 10 positive longs.



Step 4: Identify and remove any zero pairs.



The result is 9 positive longs. This represents $+0.9$.

14. Find the following sums. Illustrate your answers by modelling the sums with base ten blocks.

a. $(+1.5)+(+1.3)$

b. $(-1.4)+(-1.1)$

c. $(+1.32)+(-0.21)$

d. $(-1.23)+(+1.12)$

e.
$$\begin{array}{r} (-1.7) \\ +\ (-1.2) \\ \hline \end{array}$$

f.
$$\begin{array}{r} (-1.01) \\ +\ (+1.04) \\ \hline \end{array}$$

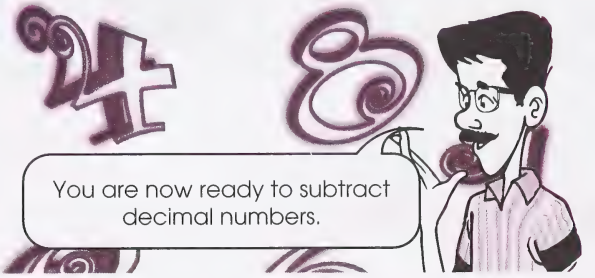
15. A stock started the trading day at \$4.75. At the end of the day the change in the stock price was $-\$0.05$. What was the closing price that day?

16. Kristy skied 8.5 km east and then she skied 10.5 km west. How far east or west of the starting point did Kristy travel?

17. The temperature in Edmonton is 4.2°C. In Fort McMurray it is colder by 10.5°C. What is the temperature in Fort McMurray?

18. Rick starts his four-wheel drive at the bottom of Death Valley, 85.9 m below sea level. He climbs 110.9 m. What is Rick's new position?

Check your answers by turning to the Appendix.



Example 4

Evaluate the expression $(-2.05)-(-1.02)$.

Solution

$$\begin{aligned}(-2.05)-(-1.02) &= (-2.05)+(+1.02)\\ &= -(2.05-1.02)\\ &= -1.03\end{aligned}$$

or

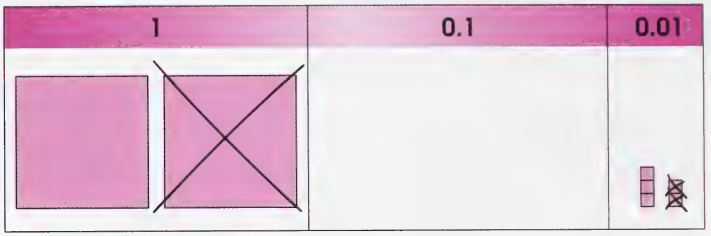
$$\begin{array}{r} -2.05 \\ -\ (-1.02) \\ \hline \end{array} = \begin{array}{r} -2.05 \\ +\ (+1.02) \\ \hline -(2.05-1.02)=-1.03 \end{array}$$

Note: You can use base ten blocks to illustrate this example.

represents -2.05.

represents -1.02.

Remove the model of -1.02 from -2.05.



The result is 1 flat and 3 small cubes. All the blocks are negative. This represents -1.03.

Example 5

Evaluate the expression $(+0.5)-(-1.4)$.

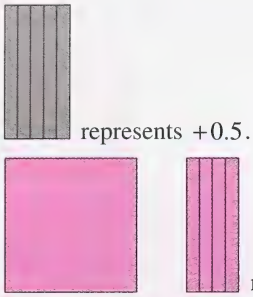
Solution

$$\begin{aligned}(+0.5)-(-1.4) &= (+0.5)+(+1.4)\\ &= +(0.5+1.4)\\ &= +1.9\end{aligned}$$

or

$$\begin{array}{r} +0.5 \\ -\ (-1.4) \\ \hline \end{array} = \begin{array}{r} +0.5 \\ +\ (+1.4) \\ \hline +(0.5+1.4)=+1.9 \end{array}$$

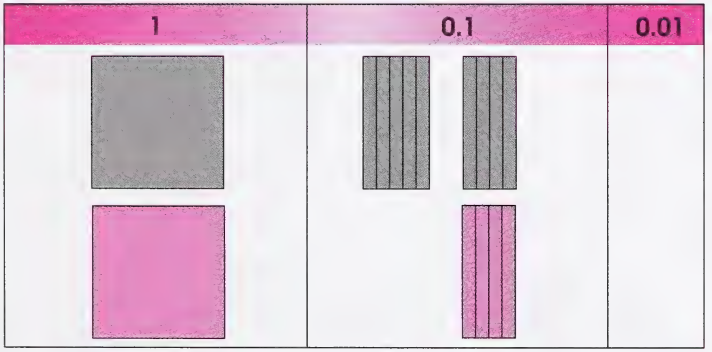
Note: You can use base ten blocks to illustrate the example.



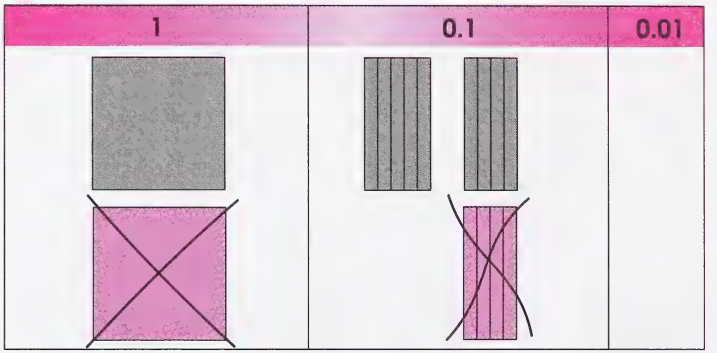
represents $+0.5$.

represents -1.4.

Step 1: You cannot remove the model of -1.4 from $+0.5$.
Therefore, to the model of $+0.5$, add sufficient zero pairs.
(Adding zero pairs will not change the value of $+0.5$)



Step 2: Remove -1.4.



The result is 1 flat and 9 longs. All the blocks are positive. This represents $+1.9$.

19. Find the following differences. Use base ten blocks to illustrate your answers.

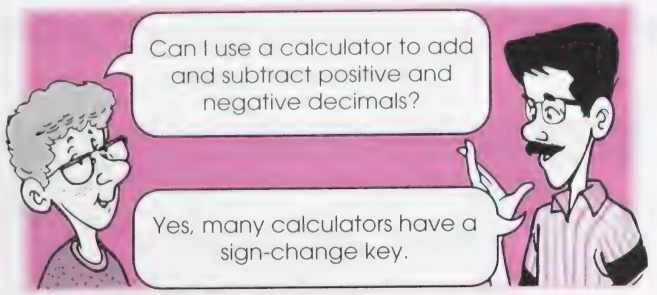
a. $(-0.5)-(-0.2)$

b. $(-1.08)-(+1.05)$

c.
$$\begin{array}{r} (+1.24) \\ -\ (+1.12) \\ \hline \end{array}$$

d.
$$\begin{array}{r} (+1.35) \\ -\ (-1.14) \\ \hline \end{array}$$

Check your answers by turning to the Appendix.



The sign-change key looks like [+/−]. The key is used to change the sign of a number.

You do **not** need to use the sign-change key to enter a positive number.

- To enter +12 press [1] [2].
- To enter +8.1 press [8] [•] [1].

You need to use the sign-change key to enter a negative number.

- To enter −12 press [1] [2] [+/−].
- To enter −8.1 press [8] [•] [1] [+/−].

The following examples show you how to use a calculator to add or subtract positive and negative decimals.

Example 6

Evaluate the expression $(-6.98)+(+7.12)$.

Solution

[6] [•] [9] [8] [+/−] [+] [7] [•] [1] [2] [=]

0.14

$\therefore\ (-6.98)+(+7.12)=+0.14$

Example 7

Evaluate the expression $(-4.95)-(-3.89)$.

Solution

[4] [•] [9] [5] [+/−] [−] [3] [•] [8] [9] [+/−] [=]

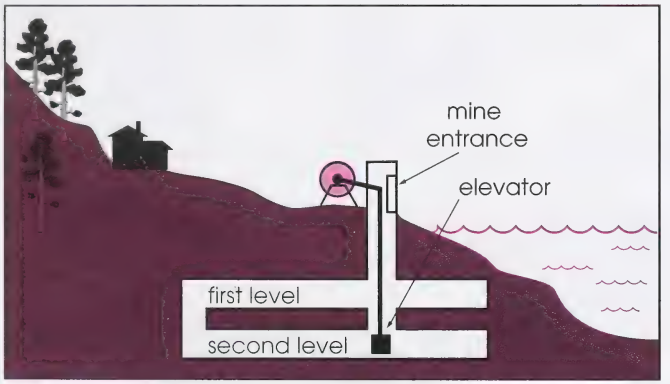
-1.06

$\therefore\ (-4.95)-(-3.89)=-1.06$

Use a scientific calculator with a sign-change key to answer questions 20 to 22.

20. Dominic's bank account was overdrawn by $43.28 on Thursday. On Friday the account had a balance of $25.86. What was the change in the balance?

21. The mine entrance is 125.8 m above sea level. The second level of the mine is 482.5 m below sea level. If the miners travelled in the elevator from the mine entrance to the second level, what was their change in position?



22. The opening price of a stock was $5.95. The closing price was $5.80. What was the change in price?

Check your answers by turning to the Appendix.

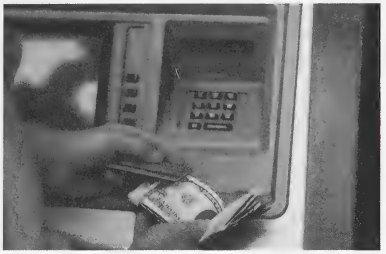
Now Try This

Use a problem-solving strategy to answer each of the following questions.

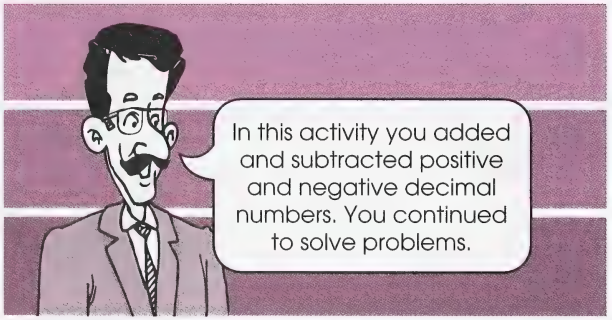
23. At the end of the school day, a teacher had 15 pencils left in her loan box. She remembered giving out 17 pencils in the morning and getting 11 back before noon, and then giving out 13 more pencils after the lunch hour. How many pencils did she have at the beginning of the day?

24. A burglar trying to escape police got on an elevator in a tall building. He went up 7 floors, down 3 floors, up 4 floors, down 8 floors, and up 2 floors. If he got out of the elevator on Floor 20, on what floor did he get into the elevator?

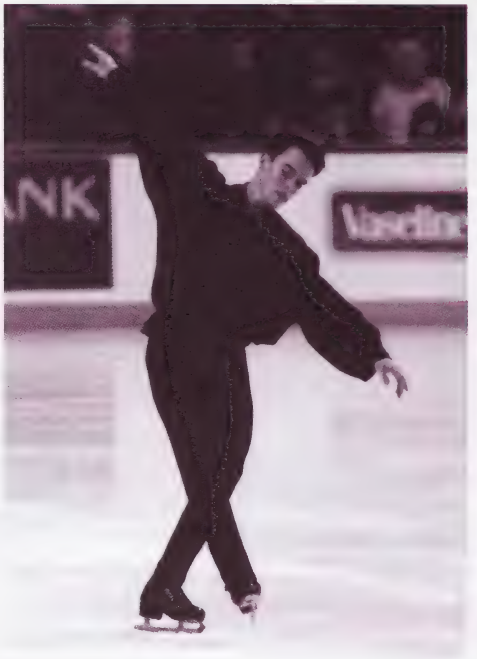
25. Marie deposited a cheque for $75.98. Next she withdrew $40.00. Marie then had $156.24 in her account. How much was in the account before these transactions?



Check your answers by turning to the Appendix.



Activity 3: Multiplying and Dividing

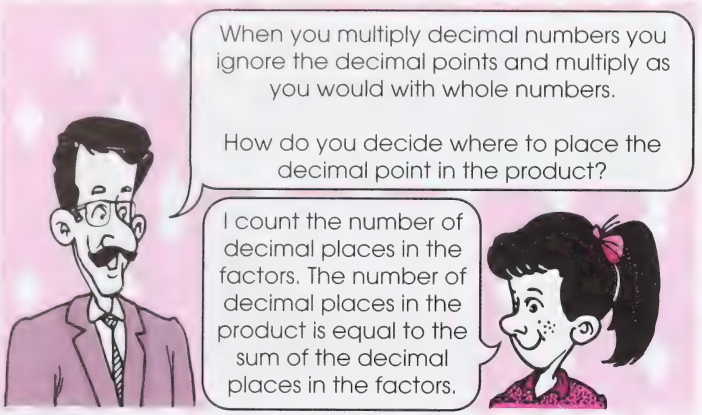


CANADIAN FIGURE SKATING ASSOCIATION, BOB BROOKS

Figure skaters, like Sebastien Britten, often study ballet. They transfer the dance skills to their skating.

You can transfer the skills you learn in one area of mathematics to another area of mathematics.

What You Already Know About Decimals



Example 1

Evaluate the expression 2×0.8.

Solution

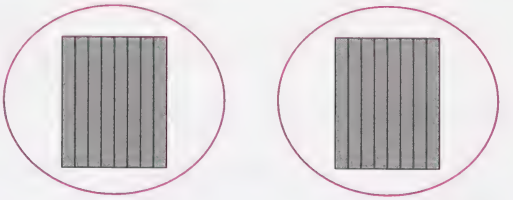
$$\begin{array}{rl} 0.8 & \leftarrow \text{1 decimal place} \\ \times \quad 2 & \leftarrow \text{0 decimal places} \\ \hline 1.6 & \leftarrow \text{1 decimal place} \end{array}$$

1 decimal place
+ 0 decimal places
1 decimal place

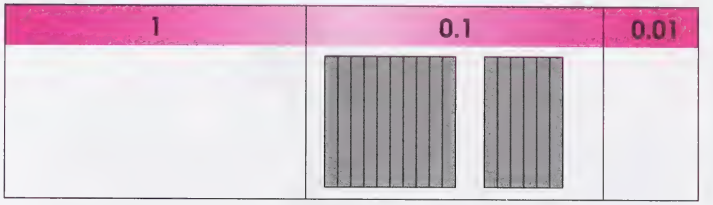
Note: You can use base ten blocks to illustrate this example.

2×0.8 means 2 groups of 0.8.

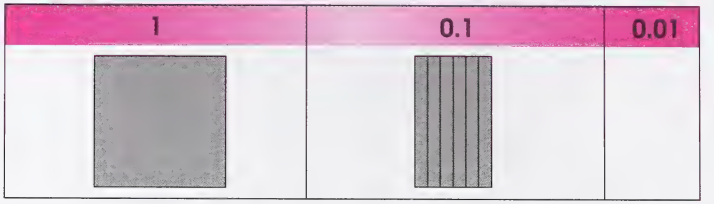
Step 1: To model the product, show 2 groups of 0.8.



Step 2: Combine the groups.



Step 3: Trade 10 longs for 1 flat.



The result is 1 flat and 6 longs. This represents 1.6.

Example 2

Evaluate the expression 1.3×1.4.

Solution

$$\begin{array}{r} 1.4 \\ \times\ 1.3 \\ \hline 42 \\ 14 \\ \hline 1.82 \end{array}$$

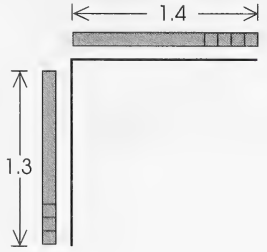
1 decimal place
1 decimal place
2 decimal places

1 decimal place
+ 1 decimal place
2 decimal places

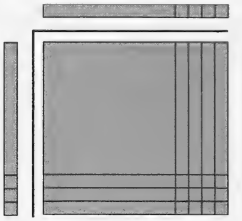
Note: You can use base ten blocks to illustrate this example.

You can think of 1.3×1.4 as a rectangular array.

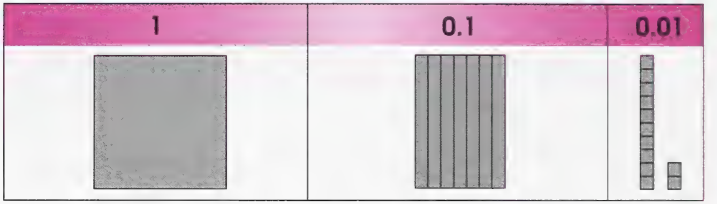
Step 1: Show the factors of the rectangular array.



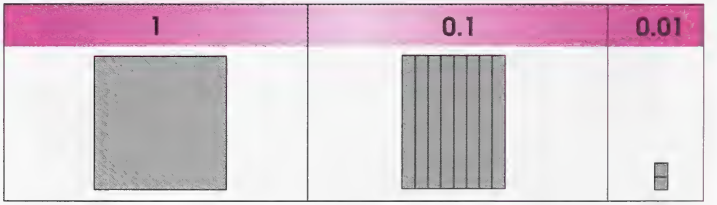
Step 2: Using these factors as guides, make a rectangle with as few blocks as possible.



Step 3: Rearrange the blocks that formed the rectangle. (Put aside the blocks for the factors.)



Step 4: Trade 10 small blocks for 1 long.



The result is 1 flat, 8 longs, and 2 small cubes. This represents 1.82.

1. Find each of the following products. Use base ten blocks to illustrate your answers.

   a. 2×1.13 **b.** 2×1.48
   c. 1.2×2.3 **d.** 1.3×1.5

2. Louise purchased 2 dresses. If each dress cost \$39.98, what was the total cost of Louise's purchases? **Note:** Do not include taxes.

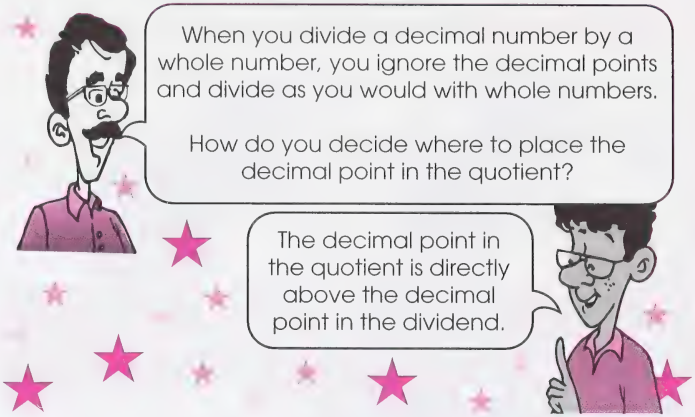
3. Gold is 7.6 times as heavy as glass. If $1\ cm^3$ of glass has a mass of 2.5 g, what is the mass of $1\ cm^3$ of gold?

4. The width of a dolphin is 0.25 times its length.

   a. A buffeo dolphin is 1.2 m long. How wide is it?

   b. A bottle-nosed dolphin is 3 m long. How wide is it?

Check your answers by turning to the Appendix.



Example 3

Evaluate the expression $2.4 \div 2$.

Solution

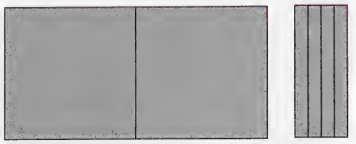
Place the decimal point in the quotient directly above the decimal point in the dividend.

$$\begin{array}{r} 1.2 \\ 2\overline{)2.4} \\ \underline{2} \\ 4 \\ \underline{4} \\ 0 \end{array}$$

Note: You can illustrate this example with base ten blocks.

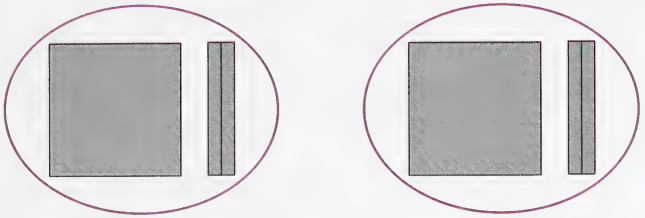
The expression $2.4 \div 2$ means, "In 2.4 there are 2 groups of **how many**?"

Step 1: Model 2.4.



represents 2.4.

Step 2: Arrange 2.4 in 2 identical groups.



The result is **1 flat and 2 longs** in each group. This represents 1.2.

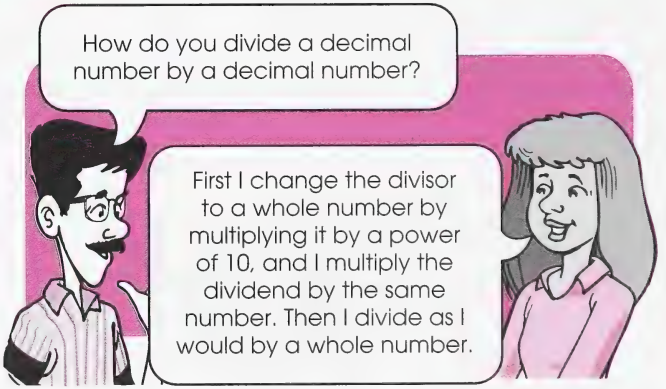
5. Find each of the following quotients. Illustrate your answers with base ten blocks.

a. $2.6 \div 2$ **b.** $1.5 \div 3$

6. Verna cut a 1.8-m length of ribbon into 2 equal pieces. How long is each piece?

7. Raol bought 3 compact discs for $56.85. How much did each CD cost? (Assume each CD costs the same.)

Check your answers by turning to the Appendix.



Example 4

Evaluate the expression $1.32 \div 1.1$.

Solution

Multiply the divisor and dividend by 10.

$1.1\overline{)1.32} \longrightarrow 11\overline{)13.2}$

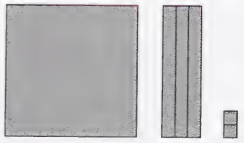
$$\begin{array}{r} 1.2 \\ 11\overline{)13.2} \\ \underline{11} \\ 22 \\ \underline{22} \\ 0 \end{array}$$

Place the decimal point in the quotient directly above the decimal point in the dividend.

Note: You can use base ten blocks to illustrate this example. Remember that multiplication and division are related.

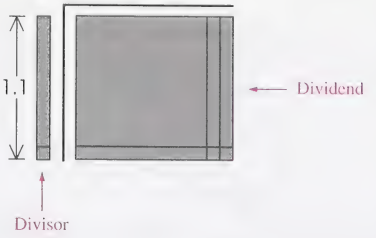
The statement $1.32 \div 1.1 =$ ☐ is the same as the statement $1.1 \times$ ☐ $= 1.32$.

Step 1: Model 1.32.

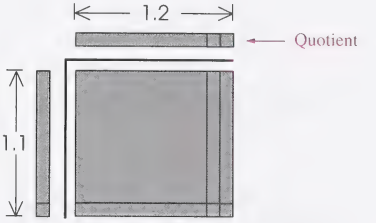


represents 1.32.

Step 2: Arrange 1.32 so that there are 1.1 rows in a rectangular array.



Step 3: To find the quotient, determine how many columns there are.



The result is 1.2 columns.

8. Find each of the following quotients. Illustrate your answers with base ten blocks.

a. $1.56 \div 1.2$ **b.** $2.16 \div 1.2$

9. Sarika's family was having a barbecue.

a. If Sarika paid $4.80 for 1.5 kg of hamburger, how much did the hamburger cost per kilogram?

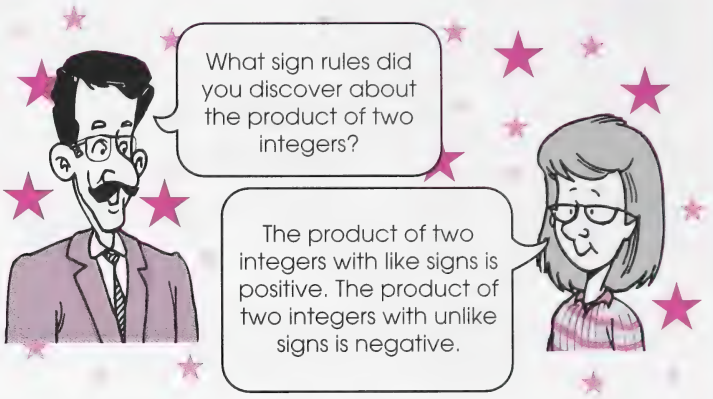
b. If Sarika made each burger using 0.15 kg of hamburger, how many burgers did she make?

10. One of the smallest insects is the minute beetle, which is 0.02 cm long. One of the largest insects is the goliath beetle, which is 14.86 cm long. How many minute beetles laid end to end would be the same length as one goliath beetle?

11. A certain book is 3.06 cm thick (not including the cover). If each page is 0.006 cm thick, how many pages does the book have?

Check your answers by turning to the Appendix.

What You Already Know About Integers



Example 1

Evaluate the expression $(+3)\times(-5)$.

Solution

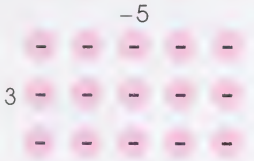
$$(+3)\times(-5) = -(3\times 5)$$
$$= -15$$

Note: You can use counters to illustrate this example.

Step 1: Model 3×5. The expression 3×5 can mean, "3 rows of 5 equals what?"

The result is 15 positive counters.

Step 2: Model $(+3)\times(-5)$. Use this reasoning. Because there is **one** negative factor, exchange the counters in Step 1 for their opposites **once**. What is the result?



The result is 15 negative counters. This represents -15.

Example 2

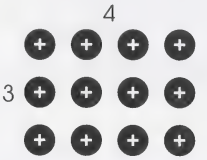
Evaluate the expression $(-3)\times(-4)$.

Solution

$$(-3)\times(-4)=+(3\times4)$$
$$=+12$$

Note: You can use counters to illustrate this example.

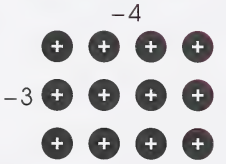
Step 1: Model 3×4. The expression 3×4 can mean, "3 rows of 4 equals what?"



The result is 12 positive counters.

Step 2: Model $(-3)\times(-4)$. Use this reasoning. For **each** negative factor, exchange the counters in Step 1 for their opposites **once**. What is the result?

This is the result of the first exchange.



This is the result of the second exchange.

The result is 12 positive counters. This represents $+12$.

12. Evaluate the following products. Use counters to confirm your answers.

a. $(+3)\times(-6)$ **b.** $(-4)\times(-5)$

13. Megyn is climbing up the face of a cliff. She is climbing at a rate of 2 m per minute.

a. How far above or below her present position was Megyn 3 min ago?

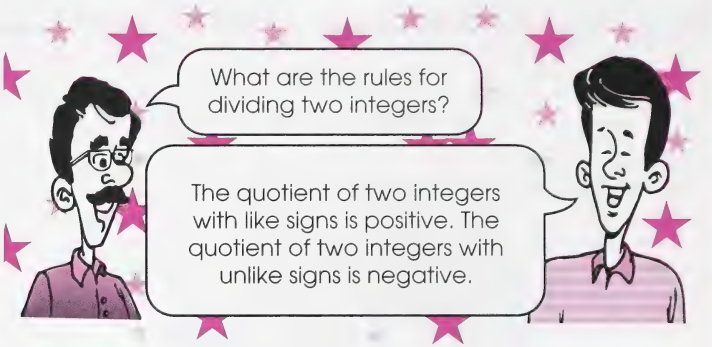
b. How far above her present position will Megyn be in 4 min?

14. Kai is in an elevator. The elevator is descending at a rate of 3 m per second.

a. How far above or below his present position will Kai be in 5 s?

b. How far above or below his present position was Kai 2 s ago?

Check your answers by turning to the Appendix.



Remember that because multiplication and division are related, you can check division by multiplying.

Example 3

Evaluate the expression $(-8)\div(+2)$. Check the quotient.

Solution

$$(-8)\div(+2)=-(8\div 2)$$
$$=-4$$

Check

$$(+2)\times(-4)=-(2\times 4)$$
$$=-8$$

Note: You can use counters to illustrate the example.

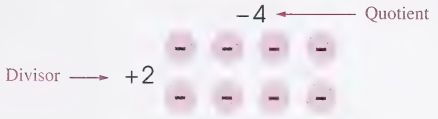
Step 1: Model $8 \div 2$. Remember that the quotient in the statement $8 \div 2 =$ ☐ is the same as the missing factor in the statement $2 \times$ ☐ $= 8$.

Ask yourself, "8 positive counters can be arranged in 2 rows of **how many**?"

The answer is, "8 positive counters can be arranged in 2 rows of **4**."

Step 2: Model $(-8) \div (+2)$. Remember that the quotient in the statement $(-8) \div (+2) =$ ☐ is the same as the missing factor in the statement $(+2) \times$ ☐ $= -8$.

The dividend is -8 and the divisor is $+2$. Decide whether the quotient is -4 or $+4$. **Hint:** The 8 positive counters in Step 1 must have been exchanged for their opposites **once**.



The quotient is -4.

Example 4

Evaluate the expression $(+15) \div (-3)$. Check the quotient.

Solution

$$(+15) \div (-3) = -(15 \div 3)$$
$$= -5$$

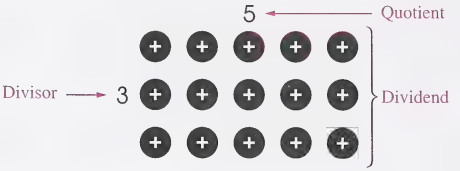
Check

$$(-3) \times (-5) = +(3 \times 5)$$
$$= 15$$

Note: You can use counters to illustrate this example.

Step 1: Model $15 \div 3$. Remember that the quotient in $15 \div 3 =$ ☐ is the same as the missing factor in $3 \times$ ☐ $= 15$.

Ask yourself, "15 positive counters can be arranged in 3 rows of **how many**?"

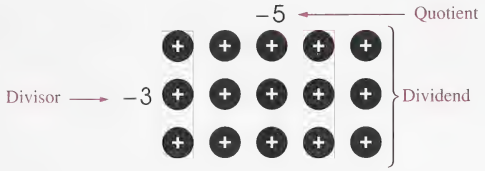


The answer is, "15 positive counters can be arranged in 3 rows of 5."

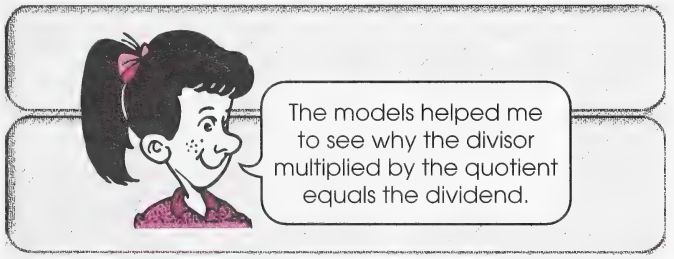
Step 2: Model $(+15)\div(-3)$.

Remember that the quotient in the statement $(+15)\div(-3)=$ ☐ is the same as the missing factor in the statement $(-3)\times$ ☐ $=+15$.

The dividend is $+15$ and the divisor is -3. Decide whether the quotient is $+5$ or -5. **Hint:** The 15 positive counters in Step 1 must have been exchanged for their opposites **twice**.



The quotient is -5.



15. Evaluate each of the following expressions. Check each quotient. Then use counters to illustrate each quotient.

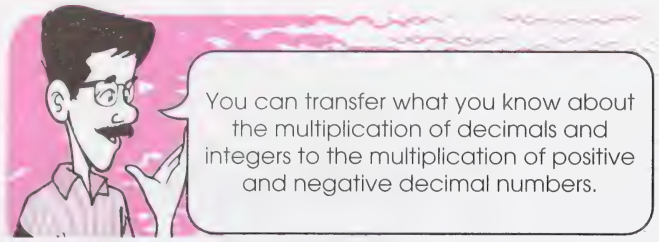
a. $(-12)\div(+3)$ **b.** $(+18)\div(-6)$

16. On Tuesday the temperature dropped 10°C in 2 hours. What was the average change in temperature per hour? **Note:** Check your answer.

17. A submarine is descending at the rate of 30 m per minute. How long will it take to descend 1800 m? **Note:** Check your answer.

Check your answers by turning to the Appendix.

Putting It All Together



Example 1

Evaluate the expression $(-1.3)\times(+1.4)$.

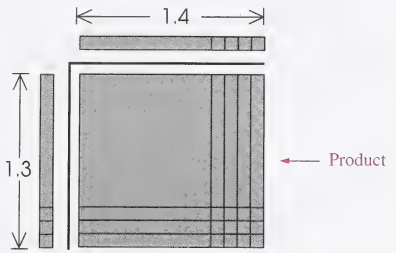
Solution

$$(-1.3)\times(+1.4) = -(1.3\times 1.4)$$
$$= -1.82$$

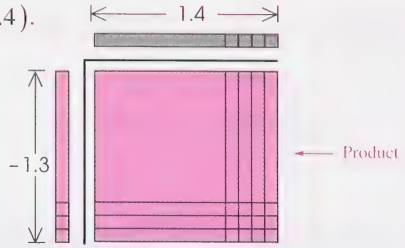
$$\begin{array}{r} 1.4 \\ \times\ 1.3 \\ \hline 42 \\ 14 \\ \hline 1.82 \end{array}$$

Note: You can use base ten blocks to illustrate this example.

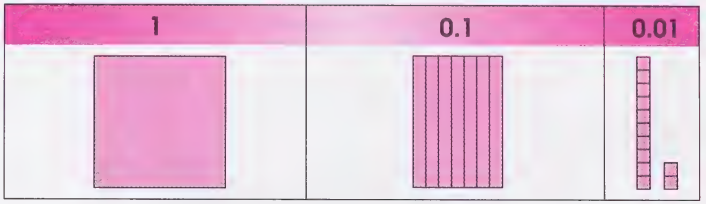
Step 1: Model 1.3×1.4.



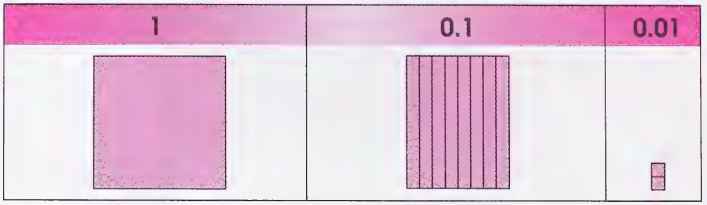
Step 2: Model $(-1.3)\times(+1.4)$.
Use this reasoning. Because one of the factors is negative, exchange the blocks representing the product for their opposites once.



Step 3: Rearrange the blocks that formed the rectangle. (Put aside the blocks for the factors.)



Step 4: Trade 10 small blocks for 1 long.



The result is 1 flat, 8 longs, and 2 small cubes. All the blocks are negative. This represents -1.82.

Example 2

Evaluate the expression $(-1.5)\times(-1.2)$.

Solution

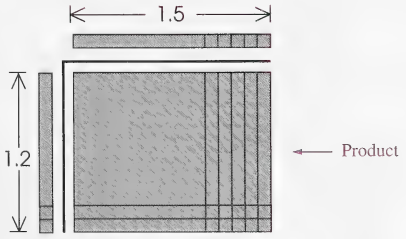
$$(-1.5)\times(-1.2) = +(1.5\times 1.2)$$
$$= +1.8$$

$$\begin{array}{r} 1.5 \\ \times\ 1.2 \\ \hline 30 \\ 15 \\ \hline 1.80 \end{array}$$

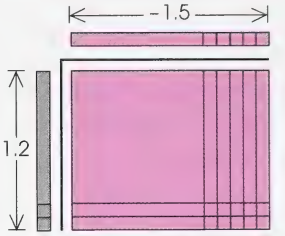
Note: You can use base ten blocks to illustrate this example.

Step 1: Model 1.2×1.5.

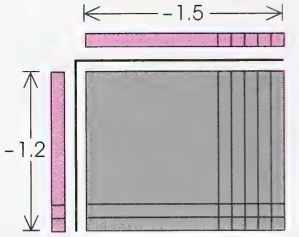
You can think of 1.5×1.2 as a rectangular array that is 1.5 columns wide and 1.2 rows deep.



Step 2: Model $(-1.5)\times(-1.2)$. Use this reasoning. For each negative factor, exchange the blocks representing the product for the opposites once.

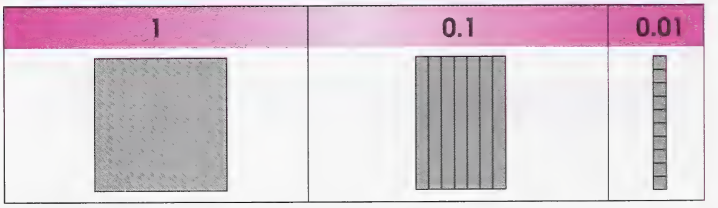


This is the result of the first exchange.

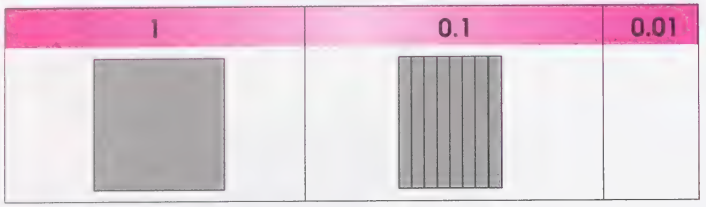


This is the result of the second exchange.

Step 3: Rearrange the blocks that formed the rectangle. (Put aside the blocks for the factors.)



Step 4: Trade 10 small cubes for 1 long.

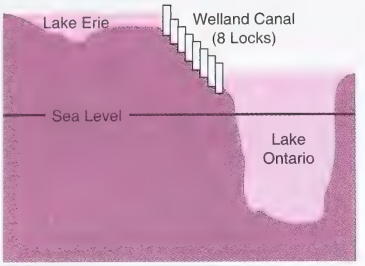


The result is 1 flat and 8 longs. All the blocks are positive. This represents $+1.8$.

18. Evaluate each of the following expressions. Use base ten blocks to confirm your answers.

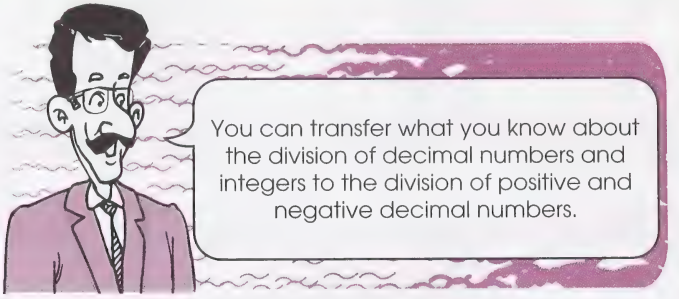
a. $(+1.1)\times(-1.8)$ **b.** $(-1.2)\times(-1.4)$

19. The Welland Canal, connecting Lake Erie and Lake Ontario, has 8 locks. One of these locks is a regulating lock. The other 7 locks are lift locks. A ship travelling downbound from Lake Erie to Lake Ontario is lowered 14.2 m by each of the lift locks. Altogether, by how much is the ship lowered?



Check your answers by turning to the Appendix.

Use one of the search engines on the Internet to discover more about the Welland Canal and other canals on the St. Lawrence Seaway.



Example 3

Evaluate the expression $(-1.21)\div(+1.1)$. Check the answer.

Solution

$$(-1.21)\div(+1.1) = -(1.21\div 1.1)$$
$$= -1.1$$

$1.1\overline{)1.21} \longrightarrow 11\overline{)12.1}$

$$\begin{array}{r} 1.1 \\ 11\overline{)12.1} \\ \underline{11} \\ 11 \\ \underline{11} \\ 0 \end{array}$$

Check

$$(+1.1)\times(-1.1) = -(1.1\times 1.1)$$
$$= -1.21$$

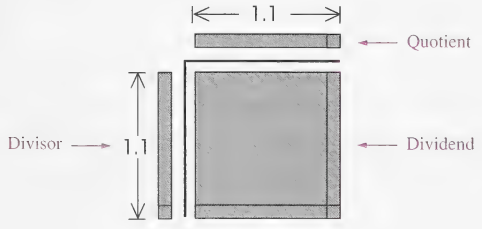
$$\begin{array}{r} 1.1 \\ \times\ 1.1 \\ \hline 11 \\ 11 \\ \hline 1.21 \end{array}$$

Note: You can use base ten blocks to illustrate this example.

Step 1: Model $1.21 \div 1.1$.

Remember that the quotient in the statement $1.21 \div 1.1 =$ ☐ is the same as the missing factor in the statement $1.1 \times$ ☐ $= 1.21$.

Ask yourself, "1.21 can be arranged in a rectangle with 1.1 rows and **how many** columns?"

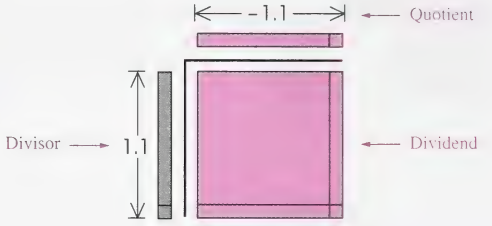


The answer is, "1.21 can be arranged in a rectangle with 1.1 rows and **1.1** columns."

Step 2: Model $(-1.21) \div (+1.1)$.

Remember that the quotient in the statement $(-1.21) \div (+1.1) =$ ☐ is the same as the missing factor in the statement $(+1.1) \times$ ☐ $= -1.21$.

The dividend is -1.21 and the divisor is $+1.1$. Decide whether the quotient is $+1.1$ or -1.1. **Hint:** The model for $+1.21$ in Step 1 must have been exchanged for its opposite **once**.



The quotient is -1.1.

Example 4

Evaluate the expression $(+1.43) \div (-1.1)$. Check the quotient.

Solution

$$(+1.43) \div (-1.1) = -(1.43 \div 1.1)$$
$$= -1.3$$

$$1.1\overline{)1.43} \longrightarrow 11\overline{)14.3}$$

$$\begin{array}{r} 1.3 \\ 11\overline{)14.3} \\ \underline{11} \\ 33 \\ \underline{33} \\ 0 \end{array}$$

Check

$(-1.1)\times(-1.3)=+(1.1\times1.3)$

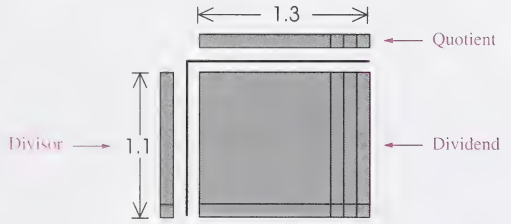
$=+1.43$

$$\begin{array}{r} 1.3 \\ \times\ 1.1 \\ \hline 13 \\ 13 \\ \hline 1.43 \end{array}$$

Note: You can use base ten blocks to illustrate this example.

Step 1: Model $1.43\div1.1$. Remember that the quotient in the statement $1.43\div1.1=$ ☐ is the same as the missing factor in the statement $1.1\times$ ☐ $=1.43$.

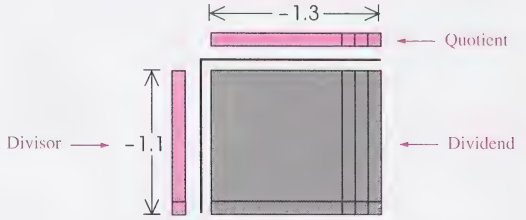
Ask yourself, "1.43 can be arranged in a rectangle with 1.1 rows and **how many** columns?"



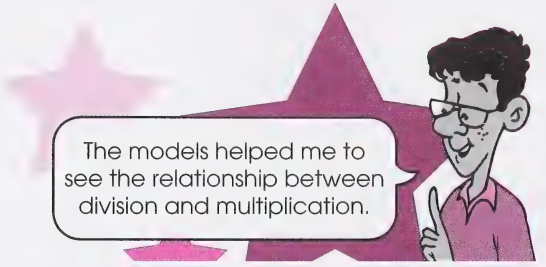
The answer is, "1.43 can be arranged in a rectangle with 1.1 rows and **1.3** columns."

Step 2: Model $(+1.43)\div(-1.1)$. Remember that the quotient in the statement $(+1.43)\div(-1.1)=$ ☐ is the same as the missing factor in the statement $(-1.1)\times$ ☐ $=+1.43$.

The dividend is $+1.43$ and the divisor is -1.1. Decide whether the quotient is $+1.3$ or -1.3. **Hint:** The model for $+1.43$ in Step 1 must have been exchanged for its opposite **twice**.



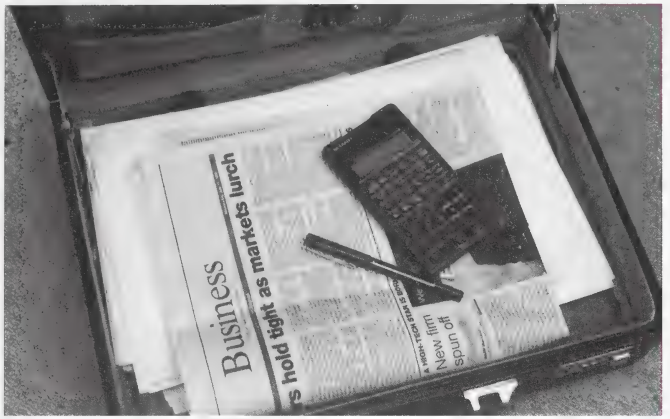
The dividend is -1.3.



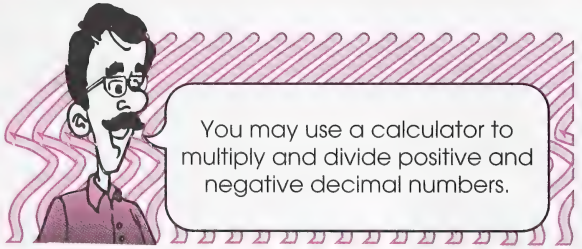
20. Evaluate each of the following expressions. Check each quotient. Use base ten blocks to illustrate the quotients.

a. $(-1.56)\div(+1.2)$ **b.** $(+1.65)\div(-1.5)$

21. The price of a stock dropped $1.50 in 5 days. On average, how much did the stock drop each day? **Note:** Check the answer.



Check your answers by turning to the Appendix.



Use a scientific calculator with a sign-change key to answer questions 22 and 23.

22. Find the puzzle entitled "What Has Twelve Humps and Lives at the North Pole?" in the Appendix. Either photocopy or pull out the page and then do the puzzle.

23. Find the puzzle entitled "Sign Up" in the Appendix. Either photocopy or pull out the page and then do the puzzle.

Check your answers by turning to the Appendix.

Did You Know?

When it is winter in Canada, people often discuss the **windchill equivalent temperature**.

The windchill equivalent temperature is an indication of how cold the wind makes the air feel.

24. **a.** Ruth plans to visit a friend. She looks at the thermometer and notices that the temperature is $-10°C$.

When she goes outside, she discovers that there is a strong wind. The combined effect of the wind and the air temperature makes it seem much colder than $-10°C$.

When Ruth arrives at her friend's house, the radio is playing. The announcer says the windchill equivalent temperature is $-24°C$!

How many times colder is the windchill equivalent temperature than the air temperature?

b. On a certain day the temperature in Yellowknife was $-18.5°C$. Because of the wind, the air felt 2 times colder. What was the windchill equivalent temperature?

Check your answers by turning to the Appendix.

INTERNET

Use the Internet to discover more about windchill equivalent temperatures. You may find this site helpful.

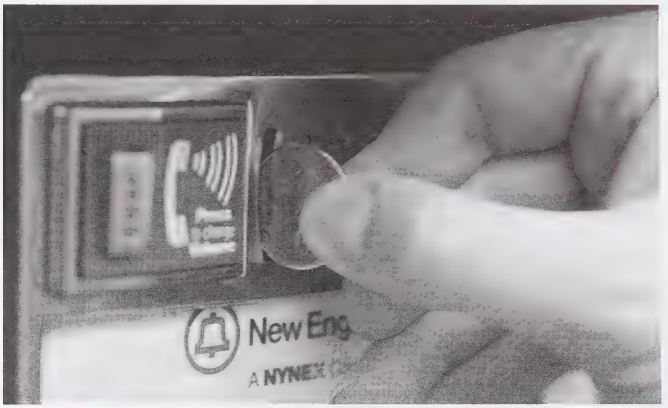
http://www.on.doe.ca/comm/windchil.htm

Now Try This

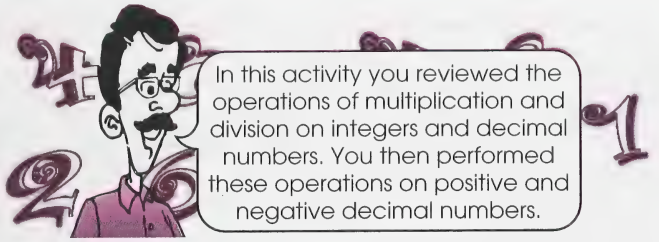
Use a problem-solving strategy to answer each of the following questions.

25. There are six sisters in the Serhijchuk family. Each sister has two brothers. Including Mr. and Mrs. Serhijchuk, how many are in the family?

26. Allistair wants to make a long-distance phone call. The telephone operator told Allistair to deposit $1. In how many ways can he do this using nickels, dimes, quarters, and loonies ($1 coins)?



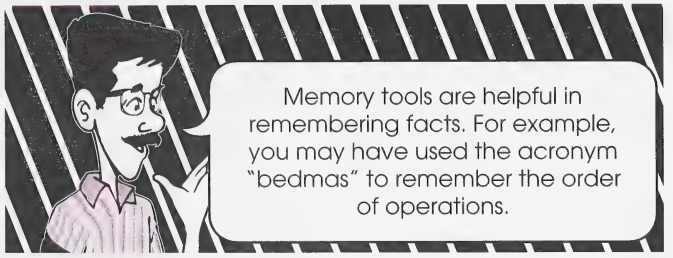
Check your answers by turning to the Appendix.



Follow-up Activities

If you had difficulties understanding the concepts in the activities, it is recommended that you do the Extra Help. If you have a clear understanding of the concepts, it is recommended that you do the Enrichment. You may decide to do both.

Extra Help

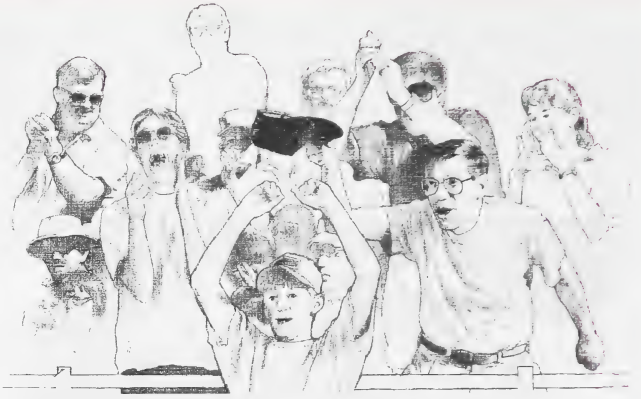


A "yeah-boo" story may help you remember the sign rules for multiplication (and also division) of signed numbers.

Suppose you are watching a game in which the home team is pitted against a visiting team. You cheer "yeah" when something happens that you like. You yell "boo" when something happens you dislike.

You can think of the home team, winning, and the cheer "yeah" as positive things.

You can think of the visitors, losing, and the yell "boo" as negative things.



Following is a list of possible outcomes of the "yeah-boo" story and the signs associated with the outcomes.

• home team	win	⟶	yeah
+	+		+
• home team	lose	⟶	boo
+	−		−
• visitors	win	⟶	boo
−	+		−
• visitors	lose	⟶	yeah
−	−		+

Use the "yeah-boo" stories to answer the following questions.

1. **a.** What is the sign of the product (or quotient) of two numbers with like signs?

   b. What is the sign of the product (or quotient) of two numbers with unlike signs?

2. Evaluate each of the following expressions.

   a. $(-1.2)\times(+1.8)$ **b.** $(-1.4)\times(-1.8)$

   c. $(+1.6)\times(-1.4)$ **d.** $(-1.2)\times(-1.5)$

   e. $(-47.7)\div(0.09)$ **f.** $(+36.9)\div(-4.1)$

Check your answers by turning to the Appendix.

Enrichment

The game "Target" is a fun game to play with one or more friends.

Find the page of game cards for "Target" in the Appendix. You may wish to laminate a photocopy of this page (or glue the page to heavier paper) before cutting out the cards. The cards will be easier to handle.

How to Play "Target"

The dealer shuffles the deck and gives 3 cards to each player.

The person to the right of the dealer picks an integer between -10 and $+10$ for the target number.

Each player builds a number sentence by adding, subtracting, multiplying, or dividing the numbers on the 3 cards.

The person who gets closer to the target number wins.

1. If -9 is the target number and you were dealt the following cards, what number sentence would you make?

   a. $-5,\ -3,\ +5$ **b.** $+7,\ -4,\ +3$

2. Play the game of "Target" with one or more friends.

Check your answers by turning to the Appendix.

Conclusion

In this section you reviewed operations on integers and decimal numbers. Then you performed operations on positive and negative decimal numbers.

You discovered situations where positive and negative decimal numbers are used in the everyday world. For example, changes in stock prices are expressed as positive and negative decimal numbers. Positive numbers show an increase in stock price; negative numbers show a decrease in stock price.

You use positive and negative integers and decimals every day. What is the last situation in which you used positive and negative numbers?

Assignment

Assignment Booklet

You are now ready to complete the assignment for Section 2.

Module Summary

NASA

In this module you developed your number sense. You performed operations on fractions. You reviewed operations on integers and decimal numbers. You performed operations on positive and negative decimal numbers.

Fractions, decimals, and positive and negative numbers are needed in the everyday world for the purposes of counting, locating, measuring, and communicating. Numbers can also be fascinating and fun.

Astronauts use numbers in their exploration of space. Their findings may make life on the Moon, or beyond, a reality one day. How do you use numbers in your life?

Final Module Assignment

Assignment Booklet

You are now ready to complete the final module assignment for Module 1.

APPENDIX

- Glossary
- Suggested Answers
- Articles/Puzzles/Games
- Cut-out Learning Aids

Glossary

Absolute value: (of an integer) the size or magnitude of the number without regard to the sign

Addition magic squares: squares in which the sum of the numbers in each row, column, or diagonal is the same

Algorithm: a set of steps for finding the answer to a problem

Cancelling: (in multiplication) the process of dividing a numerator and a denominator by a common factor

Cartesian coordinate system: a way of defining the position of a point in two-dimensional space

Complex fraction: a fraction which has a fraction in the numerator and/or in the denominator

Dividend: the number which is to be divided

Divisor: the number by which the dividend is to be divided

Factors: in a mathematical statement, the numbers being multiplied

Inverse operations: operations that undo each other

Multiplicative inverses: two numbers whose product is 1; also called **reciprocals**

Origin: on a graph, the point where the x-axis and y-axis meet

Problem: a task for which the method of finding the answer (as well as the answer) is not immediately known

Product: the result in multiplication

Quadrant: one of the four regions formed by the axes on a graph

Quotient: the number resulting from division

Subtraction magic squares: squares in which the sum of the two end numbers (in any row, column, or diagonal), minus the centre number, is the same

Technology: the application of tools, materials, and processes to problem solving; more specifically, devices and systems used in processing, transferring, storing, and communicating information through electronic media

Windchill equivalent temperature: a temperature which indicates how cold a wind makes the air feel

Suggested Answers

Section 1: Activity 1

1. Answers are given in video program.

2. $\frac{3}{10} + \frac{5}{10} = \frac{8}{10}$

$= \frac{4}{5}$

or

$$\begin{array}{r} \frac{3}{10} \\ +\ \frac{5}{10} \\ \hline \frac{8}{10} = \frac{4}{5} \end{array}$$

Melody gave away $\frac{4}{5}$ of her jewellery collection.

3. $\frac{3}{8}+\frac{1}{4}=\frac{3}{8}+\frac{2}{8}$ **or**

$=\frac{5}{8}$

$\begin{array}{r} \frac{3}{8} \\ +\ \frac{1}{4} \\ \hline \end{array} = \begin{array}{r} \frac{3}{8} \\ +\ \frac{2}{8} \\ \hline \frac{5}{8} \end{array}$

Mark spent $\frac{5}{8}$ of the day on these two activities.

4. $\frac{1}{2}+\frac{1}{4}=\frac{2}{4}+\frac{1}{4}$ **or**

$=\frac{3}{4}$

$\begin{array}{r} \frac{1}{2} \\ +\ \frac{1}{4} \\ \hline \end{array} = \begin{array}{r} \frac{2}{4} \\ +\ \frac{1}{4} \\ \hline \frac{3}{4} \end{array}$

Lucy and Ruth scored $\frac{3}{4}$ of the goals altogether.

5. $\frac{1}{3}+\frac{1}{4}=\frac{4}{12}+\frac{3}{12}$ **or**

$=\frac{7}{12}$

$\begin{array}{r} \frac{1}{3} \\ +\ \frac{1}{4} \\ \hline \end{array} = \begin{array}{r} \frac{4}{12} \\ +\ \frac{3}{12} \\ \hline \frac{7}{12} \end{array}$

Katrina used $\frac{7}{12}$ of a can of varnish altogether.

6. a. $\frac{1}{5}+\frac{2}{5}=\frac{3}{5}$ **b.** $\frac{1}{10}+\frac{6}{10}=\frac{7}{10}$ **c.** $\frac{1}{6}+\frac{4}{6}=\frac{5}{6}$

d. $\frac{1}{8}+\frac{1}{2}=\frac{5}{8}$ **e.** $\frac{2}{3}+\frac{1}{6}=\frac{5}{6}$ **f.** $\frac{2}{5}+\frac{3}{10}=\frac{7}{10}$

g. $\begin{array}{r} \frac{3}{4} \\ +\ \frac{1}{8} \\ \hline \frac{7}{8} \end{array}$ **h.** $\begin{array}{r} \frac{1}{2} \\ +\ \frac{3}{8} \\ \hline \frac{7}{8} \end{array}$ **i.** $\begin{array}{r} \frac{5}{6} \\ +\ \frac{1}{12} \\ \hline \frac{11}{12} \end{array}$

7. a. $\frac{1}{8}+\frac{3}{4}+\frac{5}{8}$ **or**

$=\frac{1}{8}+\frac{6}{8}+\frac{5}{8}$

$=\frac{12}{8}$

$=\frac{3}{2}$

$=1\frac{1}{2}$

$\begin{array}{r} \frac{1}{8} \\ \frac{3}{4} \\ +\ \frac{5}{8} \\ \hline \end{array} = \begin{array}{r} \frac{1}{8} \\ \frac{6}{8} \\ +\ \frac{5}{8} \\ \hline \frac{12}{8}=\frac{3}{2}=1\frac{1}{2} \end{array}$

b. $\frac{1}{2}+\frac{5}{6}+\frac{1}{3}$ **or**

$=\frac{3}{6}+\frac{5}{6}+\frac{2}{6}$

$=\frac{10}{6}$

$=\frac{5}{3}$

$=1\frac{2}{3}$

$\begin{array}{r} \frac{1}{2} \\ \frac{5}{6} \\ +\ \frac{1}{3} \\ \hline \end{array} = \begin{array}{r} \frac{3}{6} \\ \frac{5}{6} \\ +\ \frac{2}{6} \\ \hline \frac{10}{6}=\frac{5}{3}=1\frac{2}{3} \end{array}$

c. $\frac{1}{4}+\frac{2}{3}+\frac{1}{2}$

$=\frac{3}{12}+\frac{8}{12}+\frac{6}{12}$

$=\frac{17}{12}$

$=1\frac{5}{12}$

or

$\begin{array}{r} \frac{1}{4} \\ \frac{2}{3} \\ +\ \frac{1}{2} \\ \hline \end{array} = \begin{array}{r} \frac{3}{12} \\ \frac{8}{12} \\ +\ \frac{6}{12} \\ \hline \frac{17}{12}=1\frac{5}{12} \end{array}$

8. a. $\frac{1}{2}+\frac{2}{5}+\frac{3}{5}+\frac{3}{4}$

$=\left(\frac{2}{5}+\frac{3}{5}\right)+\left(\frac{1}{2}+\frac{3}{4}\right)$

$=\frac{5}{5}+\left(\frac{2}{4}+\frac{3}{4}\right)$

$=1+\frac{5}{4}$

$=1+1\frac{1}{4}$

$=2\frac{1}{4}$

b. $\frac{2}{5}+\frac{1}{5}+\frac{3}{10}+\frac{2}{5}$

$=\left(\frac{2}{5}+\frac{1}{5}+\frac{2}{5}\right)+\frac{3}{10}$

$=\frac{5}{5}+\frac{3}{10}$

$=1\frac{3}{10}$

c. $\frac{1}{2}+\frac{3}{4}+\frac{1}{2}+\frac{7}{8}$

$=\left(\frac{1}{2}+\frac{1}{2}\right)+\left(\frac{3}{4}+\frac{7}{8}\right)$

$=\frac{2}{2}+\left(\frac{6}{8}+\frac{7}{8}\right)$

$=1+\frac{13}{8}$

$=1+1\frac{5}{8}$

$=2\frac{5}{8}$

d. $\frac{1}{3}+\frac{1}{6}+\frac{1}{3}+\frac{1}{2}$

$=\left(\frac{1}{3}+\frac{1}{3}\right)+\left(\frac{1}{6}+\frac{1}{2}\right)$

$=\frac{2}{3}+\left(\frac{1}{6}+\frac{3}{6}\right)$

$=\frac{2}{3}+\frac{4}{6}$

$=\frac{2}{3}+\frac{2}{3}$

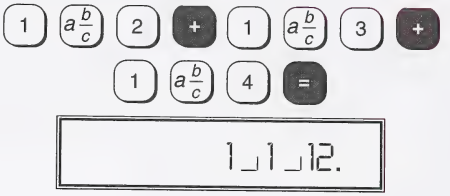
$=\frac{4}{3}$

$=1\frac{1}{3}$

9. a. **Step 1:** Estimate the answer.

The answer will be between 1 and 2.

Step 2: Press the following key sequence.



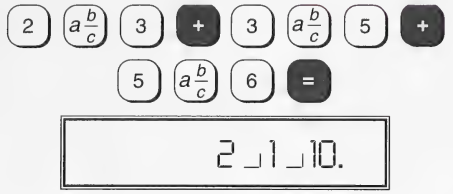
Step 3: Compare the calculated answer to the estimate.

$1\frac{1}{2}$ is between 1 and 2 so the answer is reasonable.

b. **Step 1:** Estimate the answer.

The answer will be between 1 and 3.

Step 2: Press the following key sequence.



Step 3: Compare the calculated answer to the estimate.

$2\frac{1}{10}$ is between 1 and 3 so the answer is reasonable.

10. **a.**
$$3\frac{1}{10} + 1\frac{3}{5} = 3\frac{1}{10} + 1\frac{6}{10} = 4\frac{7}{10}$$

b.
$$4\frac{1}{6} + 1\frac{2}{3} = 4\frac{1}{6} + 1\frac{4}{6} = 5\frac{5}{6}$$

c.
$$5\frac{5}{6} + 1\frac{5}{12} = 5\frac{10}{12} + 1\frac{5}{12} = 5\frac{15}{12} = 5\frac{10}{12} + 1\frac{5}{12} = 7\frac{3}{12} = 7\frac{1}{4}$$

This step can be done mentally.

d.
$$1\frac{3}{4} + 1\frac{1}{2} = 1\frac{3}{4} + 1\frac{2}{4} = 2\frac{5}{4} = 1\frac{3}{4} + 1\frac{2}{4} = 3\frac{1}{4}$$

This step can be done mentally.

11.
$$10\frac{1}{2} + 8\frac{1}{3} = 10\frac{3}{6} + 8\frac{2}{6} = 18\frac{5}{6}$$

The two charities collected $\$18\frac{5}{6}$ million altogether.

12. **a.**
$$1\frac{7}{8} + 2\frac{3}{4} = \frac{15}{8} + \frac{11}{4} = \frac{15}{8} + \frac{22}{8} = \frac{37}{8} = 4\frac{5}{8}$$

b.
$$1\frac{1}{5} + 2\frac{3}{10} = \frac{6}{5} + \frac{23}{10} = \frac{12}{10} + \frac{23}{10} = \frac{35}{10} = \frac{7}{2} = 3\frac{1}{2}$$

c. $1\frac{2}{3}+3\frac{3}{4}=\frac{5}{3}+\frac{15}{4}$

$=\frac{20}{12}+\frac{45}{12}$

$=\frac{65}{12}$

$=5\frac{5}{12}$

13. $1\frac{3}{4}+1\frac{1}{2}=\frac{7}{4}+\frac{3}{2}$

$=\frac{7}{4}+\frac{6}{4}$

$=\frac{13}{4}$

$=3\frac{1}{4}$

Mr. Crowell transplanted $3\frac{1}{4}$ dozen tulips.

14.
$$\begin{array}{r} 1\ \frac{3}{4} \\ +\ 2\ \frac{3}{4} \\ \hline \frac{6}{4} \end{array} = \begin{array}{r} {\scriptstyle 1}1\frac{3}{4} \\ +\ 2\frac{3}{4} \\ \hline 4\frac{2}{4}=4\frac{1}{2} \end{array}$$

This step can be done mentally.

Altogether, Franscesca spent $4\frac{1}{2}$ h working in the greenhouse on these two days.

15. Which Italian insects most often fall in love?—ROME ANTS

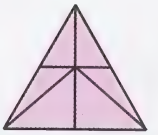
Now Try This

16. You can use the guess, check, and revise strategy to solve this problem. Answers will vary. Here is one set of solutions.

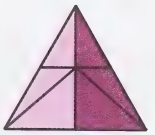
a. $\frac{3}{4}=\frac{1}{2}+\frac{1}{4}$ **b.** $\frac{5}{6}=\frac{1}{3}+\frac{1}{3}+\frac{1}{6}$

c. $\frac{11}{12}=\frac{1}{2}+\frac{1}{4}+\frac{1}{6}$ **d.** $\frac{7}{8}=\frac{1}{2}+\frac{1}{4}+\frac{1}{8}$

17. Step 1: You can use diagrams to help you make an organized list.



There is 1 large triangle like this.



There are 2 triangles like this.

There are 2 triangles like this.

There are 4 triangles like this.

There are 2 triangles like this.

There are 2 triangles like this.

Step 2: Find the total number of triangles.

$$1+2+2+4+2+2=13$$

The diagram has 13 triangles.

Section 1: Activity 2

1. Answers are given in the video program.

2. $\frac{7}{8}-\frac{1}{8}=\frac{6}{8}$ **or**

$=\frac{3}{4}$

$\frac{7}{8}$

$-\ \frac{1}{8}$

$\frac{6}{8}=\frac{3}{4}$

The Yakimchuks used $\frac{3}{4}$ of a tank of gas.

3. $\frac{3}{4}-\frac{1}{4}=\frac{2}{4}$ **or**

$=\frac{1}{2}$

$\frac{3}{4}$

$-\ \frac{1}{4}$

$\frac{2}{4}=\frac{1}{2}$

It took Lori $\frac{1}{2}$ h longer.

4. $1-\frac{1}{4}=\frac{4}{4}-\frac{1}{4}$ **or**

$=\frac{3}{4}$

1

$-\ \frac{1}{4}$

$=\ \frac{4}{4}-\frac{1}{4}=\frac{3}{4}$

Frank had $\frac{3}{4}$ of his garden for other plants.

5. $\frac{1}{2}-\frac{1}{3}=\frac{3}{6}-\frac{2}{6}$ **or**

$=\frac{1}{6}$

$\frac{1}{2}$

$-\ \frac{1}{3}$

$=\ \frac{3}{6}-\frac{2}{6}=\frac{1}{6}$

Jana ate $\frac{1}{6}$ of a bag of popcorn on the bus.

6. a. $\frac{7}{8}-\frac{1}{8}=\frac{6}{8}$

b. $\frac{3}{4}-\frac{1}{2}=\frac{1}{4}$

c. $\frac{1}{2}-\frac{1}{4}=\frac{1}{4}$

d. $\frac{2}{5}-\frac{1}{10}=\frac{3}{10}$

e. $\frac{7}{12}-\frac{1}{6}=\frac{5}{12}$

f. $\frac{5}{6}-\frac{2}{3}=\frac{1}{6}$

7. a.
$$\begin{array}{r} 3\frac{1}{2} \\ -\ 1\frac{1}{4} \\ \hline \end{array} = \begin{array}{r} 3\frac{2}{4} \\ -\ 1\frac{1}{4} \\ \hline 2\frac{1}{4} \end{array}$$

b.
$$\begin{array}{r} 4\frac{3}{4} \\ -\ 1\frac{1}{2} \\ \hline \end{array} = \begin{array}{r} 4\frac{3}{4} \\ -\ 1\frac{2}{4} \\ \hline 3\frac{1}{4} \end{array}$$

c.
$$\begin{array}{r} 5\frac{1}{8} \\ -\ 2\frac{3}{4} \\ \hline \end{array} = \begin{array}{r} 5\frac{1}{8} \\ -\ 2\frac{6}{8} \\ \hline \end{array} = \begin{array}{r} 4\frac{9}{8} \\ -\ 2\frac{6}{8} \\ \hline 2\frac{3}{8} \end{array}$$

d.
$$\begin{array}{r} 6\frac{1}{4} \\ -\ 3\frac{5}{8} \\ \hline \end{array} = \begin{array}{r} 6\frac{2}{8} \\ -\ 3\frac{5}{8} \\ \hline \end{array} = \begin{array}{r} 5\frac{10}{8} \\ -\ 3\frac{5}{8} \\ \hline 2\frac{5}{8} \end{array}$$

8.
$$\begin{array}{r} 9\frac{1}{2} \\ -\ 8\frac{3}{4} \\ \hline \end{array} = \begin{array}{r} 9\frac{2}{4} \\ -\ 8\frac{3}{4} \\ \hline \end{array} = \begin{array}{r} 8\frac{6}{4} \\ -\ 8\frac{3}{4} \\ \hline \frac{3}{4} \end{array}$$

Last week, Tiffany worked $\frac{3}{4}$ h longer than Gerhardt.

9. a.
$$5\frac{7}{8} - 2\frac{3}{4} = \frac{47}{8} - \frac{11}{4}$$
$$= \frac{47}{8} - \frac{22}{8}$$
$$= \frac{25}{8}$$
$$= 3\frac{1}{8}$$

b.
$$4\frac{2}{5} - 2\frac{7}{10} = \frac{22}{5} - \frac{27}{10}$$
$$= \frac{44}{10} - \frac{27}{10}$$
$$= \frac{17}{10}$$
$$= 1\frac{7}{10}$$

c.
$$5\frac{1}{6} - 3\frac{7}{12} = \frac{31}{6} - \frac{43}{12}$$
$$= \frac{62}{12} - \frac{43}{12}$$
$$= \frac{19}{12}$$
$$= 1\frac{7}{12}$$

10.
$$4 - 1\frac{1}{2} = 4 - \frac{3}{2}$$
$$= \frac{8}{2} - \frac{3}{2}$$
$$= \frac{5}{2}$$
$$= 2\frac{1}{2}$$

George must still paint $2\frac{1}{2}$ chairs.

11. Where do trees go when one tree has a birthday?
—TO ITS LUMBER PARTY

Now Try This

12. You will need to look at this problem from a different point of view. Here is one possibility.

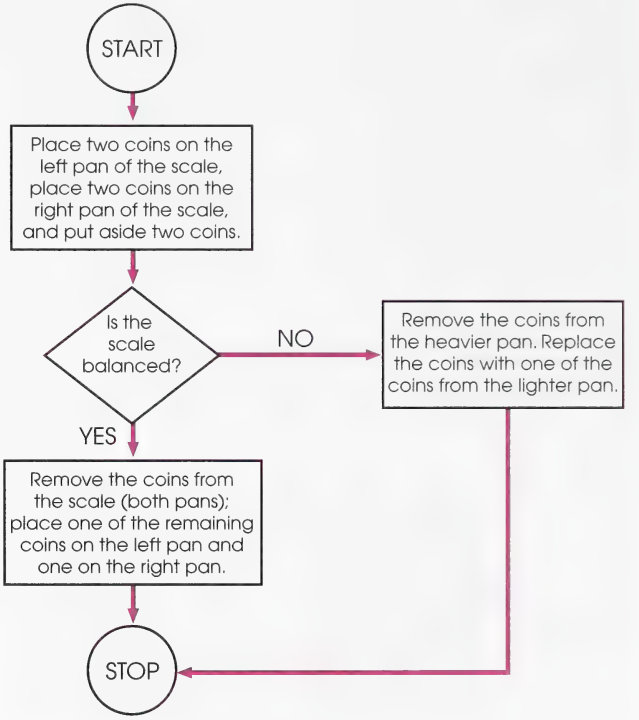
Arrange 3 pennies like this.

Put the fourth penny on top of the other 3 coins.

Other answers are possible.

13. Use logic to solve this problem.

The steps used to find the counterfeit coin are listed in the following flow chart.



The pan that is lighter has the counterfeit coin.

Section 1: Activity 3

1. Answers to the video assignment are in the video program.

2. **a.** The numerator of each answer (before it is simplified) is the product of the numerators of the factors.

   b. The denominator of each answer (before it is simplified) is the product of the denominators of the factors.

3. $\frac{1}{2}\times\frac{3}{4}=\frac{3}{8}$

   Julio mowed $\frac{3}{8}$ of the entire lawn in the afternoon.

4. $\frac{1}{3}\times\frac{3}{4}=\frac{3}{12}$

   $=\frac{1}{4}$

   It takes Dale $\frac{1}{4}$ h to ride his bike from home to the store.

5. $\frac{1}{2}\times\frac{1}{2}=\frac{1}{4}$

   Of the entire batch of cookies, $\frac{1}{4}$ had raisins and were frosted.

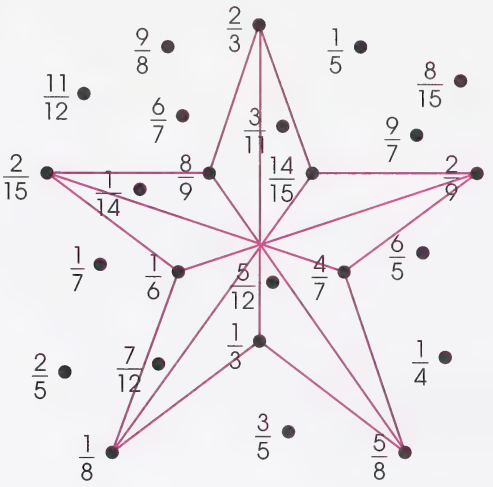
6. $\frac{3}{4}\times\frac{1}{3}=\frac{3}{12}$

   $=\frac{1}{4}$

   Of the customers, $\frac{1}{4}$ had both soup and salad.

7. **a.** $\frac{1}{3}\times\frac{1}{2}=\frac{1}{6}$ **b.** $\frac{3}{4}\times\frac{3}{5}=\frac{9}{20}$ **c.** $\frac{2}{3}\times\frac{4}{5}=\frac{8}{15}$

8. A star is made.



9. **a.** $\frac{7}{8}\times\frac{4}{5}\times\frac{5}{8}=\frac{7\times\overset{1}{\cancel{4}}\times\overset{1}{\cancel{5}}}{8\times\underset{1}{\cancel{5}}\times\underset{2}{\cancel{8}}}=\frac{7}{16}$ $\frac{5}{5}=\frac{1}{1};\ \frac{4}{8}=\frac{1}{2}$

   or

   $\frac{7}{8}\times\frac{4}{5}\times\frac{5}{8}=\frac{7\times\overset{1}{\cancel{4}}\times\overset{1}{\cancel{5}}}{\underset{2}{\cancel{8}}\times\underset{1}{\cancel{5}}\times 8}=\frac{7}{16}$ $\frac{5}{5}=\frac{1}{1};\ \frac{4}{8}=\frac{1}{2}$

b. $\frac{1}{4}\times\frac{3}{5}\times\frac{2}{3}=\frac{1\times\overset{1}{\cancel{3}}\times\overset{1}{\cancel{2}}}{\underset{2}{\cancel{4}}\times 5\times\underset{1}{\cancel{3}}}=\frac{1}{10}$

$\frac{3}{3}=\frac{1}{1};\ \frac{2}{4}=\frac{1}{2}$

c. $\frac{3}{5}\times\frac{4}{9}\times\frac{5}{6}=\frac{\overset{1}{\cancel{3}}\times\overset{2}{\cancel{4}}\times\overset{1}{\cancel{5}}}{\underset{1}{\cancel{5}}\times\underset{3}{\cancel{9}}\times\underset{3}{\cancel{6}}}=\frac{2}{9}$

$\frac{3}{9}=\frac{1}{3};\ \frac{4}{6}=\frac{2}{3};\ \frac{5}{5}=\frac{1}{1}$

or

$\frac{3}{5}\times\frac{4}{9}\times\frac{5}{6}=\frac{\overset{1}{\cancel{3}}\times 4\times\overset{1}{\cancel{5}}}{\underset{1}{\cancel{5}}\times 9\times\underset{2}{\cancel{6}}}=\frac{4}{18}$

$\frac{3}{6}=\frac{1}{2};\ \frac{5}{5}=\frac{1}{1}$

$=\frac{2}{9}$

d. $\frac{2}{3}\times\frac{5}{6}\times\frac{9}{10}=\frac{\overset{1}{\cancel{2}}\times\overset{1}{\cancel{5}}\times\overset{3}{\cancel{9}}}{\underset{1}{\cancel{3}}\times\underset{3}{\cancel{6}}\times\underset{2}{\cancel{10}}}=\frac{3}{6}$

$\frac{2}{6}=\frac{1}{3};\ \frac{5}{10}=\frac{1}{2};\ \frac{9}{3}=\frac{3}{1}$

$=\frac{1}{2}$

or

$\frac{2}{3}\times\frac{5}{6}\times\frac{9}{10}=\frac{2\times\overset{1}{\cancel{5}}\times\overset{3}{\cancel{9}}}{3\times\underset{2}{\cancel{6}}\times\underset{2}{\cancel{10}}}=\frac{6}{12}$

$\frac{5}{10}=\frac{1}{2};\ \frac{9}{6}=\frac{3}{2}$

$=\frac{1}{2}$

10. a. $\frac{1}{\underset{1}{\cancel{2}}}\times\frac{\overset{1}{\cancel{2}}}{3}=\frac{1}{3}$ **b.** $\frac{1}{\underset{1}{\cancel{2}}}\times\frac{\overset{1}{\cancel{2}}}{\underset{1}{\cancel{3}}}\times\frac{\overset{1}{\cancel{3}}}{4}=\frac{1}{4}$ **c.** $\frac{1}{\underset{1}{\cancel{2}}}\times\frac{\overset{1}{\cancel{2}}}{\underset{1}{\cancel{3}}}\times\frac{\overset{1}{\cancel{3}}}{\underset{1}{\cancel{4}}}\times\frac{\overset{1}{\cancel{4}}}{5}=\frac{1}{5}$

11. Each answer has the numerator of the first factor and the denominator of the last factor.

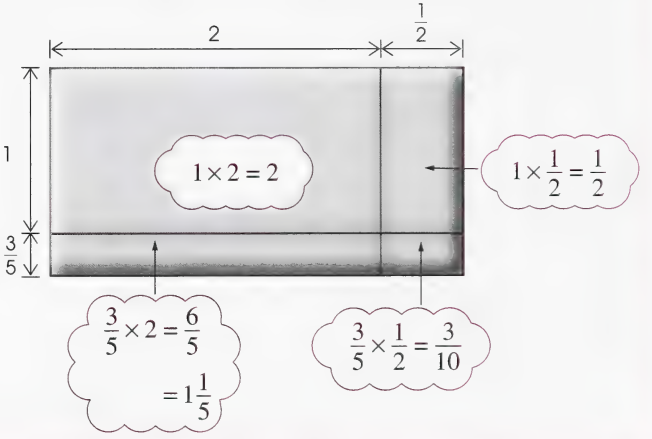
12. $\frac{1}{2}\times\frac{2}{3}\times\frac{3}{4}\times\frac{4}{5}\times\cdots\times\frac{49}{50}=\frac{1}{50}$

13. a. $1\frac{3}{5}\times 2\frac{1}{2}=\frac{8}{5}\times\frac{5}{2}$

$=\frac{\overset{4}{\cancel{8}}\times\overset{1}{\cancel{5}}}{\underset{1}{\cancel{5}}\times\underset{1}{\cancel{2}}}$

$=4$

The following rectangle can be used to illustrate the product.



Ask yourself, "What is the total area of the four sections of the rectangle?"

$$\therefore\ 1\frac{3}{5}\times 2\frac{1}{2}=4$$

$$2+1\frac{1}{5}+\frac{1}{2}+\frac{3}{10}$$

$$=2+1\frac{2}{10}+\frac{5}{10}+\frac{3}{10}$$

$$=3\frac{10}{10}$$

$$=4$$

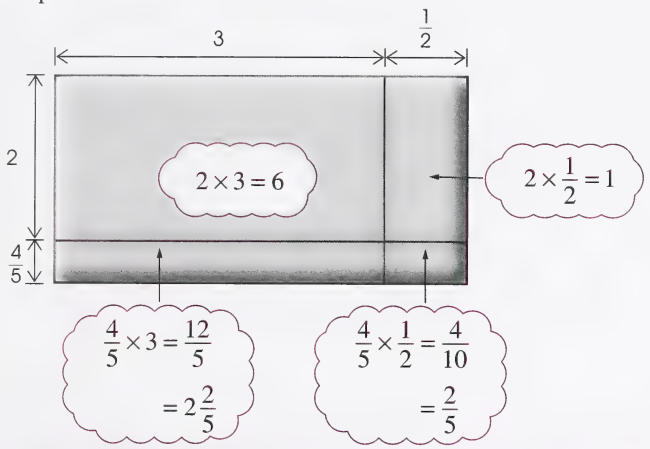
b. $2\frac{4}{5}\times 3\frac{1}{2}=\frac{14}{5}\times\frac{7}{2}$

$$=\frac{\overset{7}{\cancel{14}}\times 7}{5\times\underset{1}{\cancel{2}}}$$

$$=\frac{49}{5}$$

$$=9\frac{4}{5}$$

The following rectangle can be used to illustrate the product.



Ask yourself, "What is the total area of the four sections of the rectangle?"

$$6+2\frac{2}{5}+1+\frac{2}{5}=9\frac{4}{5}$$

$$\therefore\ 2\frac{4}{5}\times 3\frac{1}{2}=9\frac{4}{5}$$

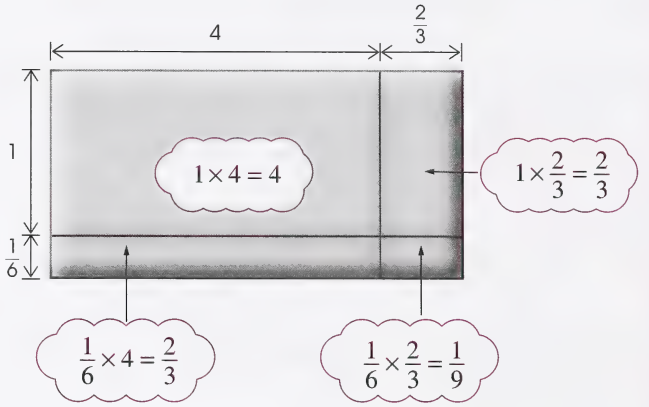
c. $1\frac{1}{6}\times 4\frac{2}{3}=\frac{7}{6}\times\frac{14}{3}$

$$=\frac{7\times\overset{7}{\cancel{14}}}{\underset{3}{\cancel{6}}\times 3}$$

$$=\frac{49}{9}$$

$$=5\frac{4}{9}$$

The following rectangle can be used to illustrate the product.



Ask yourself, "What is the total area of the four sections of the rectangle?"

$$\therefore\ 1\frac{1}{6}\times 4\frac{2}{3}=5\frac{4}{9}$$

$$4+\frac{2}{3}+\frac{2}{3}+\frac{1}{9}$$
$$=4+\frac{6}{9}+\frac{6}{9}+\frac{1}{9}$$
$$=4+\frac{13}{9}$$
$$=4+1\frac{4}{9}$$
$$=5\frac{4}{9}$$

14. a. $2\times 4\frac{1}{2}=2\times\frac{9}{2}$

$$=\frac{\overset{1}{\cancel{2}}\times 9}{\underset{1}{\cancel{2}}}$$
$$=9$$

For twice the recipe, 9 carrots are required.

b. $\frac{1}{2}\times 4\frac{1}{2}=\frac{1}{2}\times\frac{9}{2}$

$$=\frac{9}{4}$$
$$=2\frac{1}{4}$$

For half the recipe, $2\frac{1}{4}$ carrots are required.

15. a. **Step 1:** Estimate the answer.

Rounding	Front-end Digits
$5\frac{1}{4}\times 4\frac{1}{4}\doteq 5\times 4$	$5\frac{1}{4}\times 4\frac{1}{4}\doteq 5\times 4$
$\doteq 20$	$\doteq 20$
There were about 20 stitches in the first square.	There were about 20 stitches in the first square.

Step 2: Press the following key sequence.

Step 3: Compare the calculated answer to the estimate.

$$22\frac{5}{16}\doteq 20$$

So, the answer is reasonable.

The first square had $22\frac{5}{16}$ stitches.

b. **Step 1:** Estimate the answer.

Rounding

$$5\frac{1}{2} \times 3\frac{1}{2} \doteq 6 \times 4$$
$$\doteq 24$$

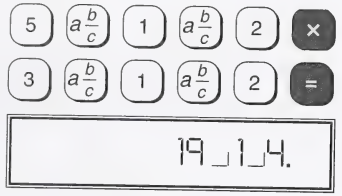
There were about 24 stitches in the second square.

Front-end Digits

$$5\frac{1}{2} \times 3\frac{1}{2} \doteq 5 \times 3$$
$$\doteq 15$$

There were about 15 stitches in the second square.

Step 2: Press the following key sequence.



Step 3: Compare the calculated answer to the estimate.

Rounding

$19\frac{1}{4} \doteq 24$

Front-end Digits

$19\frac{1}{4} \doteq 15$

So, the answer is reasonable.

The second square had $19\frac{1}{4}$ stitches.

16. The hidden message is MULTIPLICATION IS RATED X.

Now Try This

17. **a.** **Step 1:** Calculate the number of people who spoke French.

$$\frac{3}{4} \times 20 = \frac{3 \times \overset{5}{\cancel{20}}}{\underset{1}{\cancel{4}}}$$
$$= 15$$

Of the people in the group, 15 people spoke French.

Step 2: Calculate the number of people who spoke only English.

$$20 - 15 = 5$$

Of the people in the group, 5 spoke only English.

b. **Step 1:** Calculate the number of people who spoke English.

$$\frac{4}{5} \times 20 = \frac{4 \times \overset{4}{\cancel{20}}}{\underset{1}{\cancel{5}}}$$
$$= 16$$

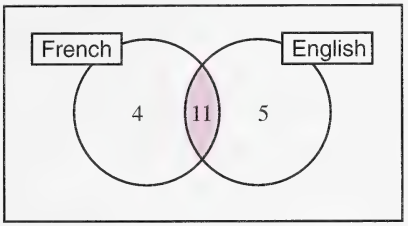
Of the people in the group, 16 people spoke English.

Step 2: Calculate the number of people who spoke only French.

$$20 - 16 = 4$$

Of the people in the group, 4 people spoke only French.

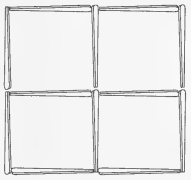
c. Make a Venn diagram to help you calculate the number of people who spoke both French and English.



Of the people in the group, 11 spoke both French and English.

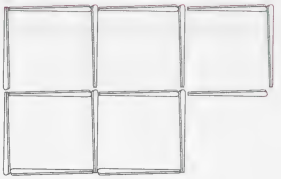
18. You may use patterns and diagrams to help you solve this problem.

a.



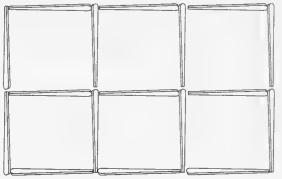
The minimum number of toothpicks needed to make 4 identical squares is 12.

b.



The minimum number of toothpicks needed to make 5 identical squares is 15.

c.



The minimum number of toothpicks needed to make 6 identical squares is 17.

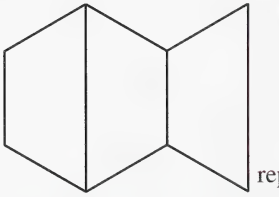
Section 1: Activity 4

1. Answers to the video assignment are given in the video program.

2. Yes, dividing $\frac{3}{4}$ by 3 is the same as multiplying $\frac{3}{4}$ by $\frac{1}{3}$.

Note: You can illustrate this by using pattern blocks.

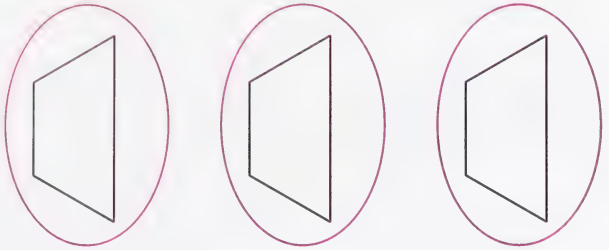
Step 1: Model $\frac{3}{4} \div 3$.



The expression $\frac{3}{4} \div 3$ means, "In $\frac{3}{4}$, there are 3 groups of **how many**?"

represents $\frac{3}{4}$.

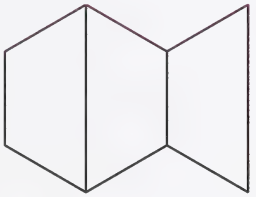
As the following diagram shows, in $\frac{3}{4}$ there are 3 groups of $\frac{1}{4}$. (The block in each group represents $\frac{1}{4}$ of the whole.)



$\therefore \frac{3}{4} \div 3 = \frac{1}{4}$

Step 2: Model $\frac{1}{3} \times \frac{3}{4}$.

The expression $\frac{1}{3} \times \frac{3}{4}$ means,
"1 of 3 equal parts of $\frac{3}{4}$."



represents $\frac{3}{4}$.

As the following diagram shows, 1 of 3 equal parts of $\frac{3}{4}$ is $\frac{1}{4}$.

$\therefore \frac{1}{3} \times \frac{3}{4} = \frac{1}{4}$

These models show that dividing $\frac{3}{4}$ by 3 is the same as multiplying $\frac{3}{4}$ by $\frac{1}{3}$.

3. $\frac{7}{12} \div 7 = \frac{7}{12} \times \frac{1}{7}$

$= \frac{\overset{1}{\cancel{7}} \times 1}{12 \times \underset{1}{\cancel{7}}}$

$= \frac{1}{12}$

Each person will receive $\frac{1}{12}$ of a carton of eggs.

4. $\frac{3}{4} \div 9 = \frac{3}{4} \times \frac{1}{9}$

$= \frac{\overset{1}{\cancel{3}} \times 1}{4 \times \underset{3}{\cancel{9}}}$

$= \frac{1}{12}$

Myrtle will spend $\frac{1}{12}$ h on each task.

5. Answers are given in the video program.

6. **a.** The quotient of two fractions is less than 1 when the divisor is greater than the dividend.

b. The quotient of two fractions is greater than 1 when the divisor is less than the dividend.

7. **a.** $\frac{5}{6} \div \frac{1}{6} = 5 \div 1$ **or** $\frac{5}{6} \times 6 = \frac{5}{6} \times \frac{6}{1}$

$= 5$

$= \frac{5 \times \overset{1}{\cancel{6}}}{\underset{1}{\cancel{6}} \times 1}$

$= \frac{5}{1}$

$= 5$

If the servings are each $\frac{1}{6}$ of a cake, 5 servings can be made.

b. $\frac{5}{6} \div \frac{1}{3} = \frac{5}{6} \div \frac{2}{6}$ **or** $\frac{5}{6} \div \frac{1}{3} = \frac{5}{6} \times \frac{3}{1}$

$= 5 \div 2$

$= \frac{5}{2}$

$= 2\frac{1}{2}$

$= \frac{5 \times \overset{1}{\cancel{3}}}{\underset{2}{\cancel{6}} \times 1}$

$= \frac{5}{2}$

$= 2\frac{1}{2}$

If the servings are each $\frac{1}{3}$ of a cake, $2\frac{1}{2}$ servings can be made.

c. $\frac{5}{6} \div \frac{1}{4} = \frac{10}{12} \div \frac{3}{12}$ **or** $\frac{5}{6} \div \frac{1}{4} = \frac{5}{6} \times \frac{4}{1}$

$= 10 \div 3$

$= \frac{10}{3}$

$= 3\frac{1}{3}$

$= \frac{5 \times \overset{2}{\cancel{4}}}{\underset{3}{\cancel{6}} \times 1}$

$= \frac{10}{3}$

$= 3\frac{1}{3}$

If the servings are each $\frac{1}{4}$ of a cake, $3\frac{1}{3}$ servings can be made.

8. a. $\frac{3}{4} \div \frac{1}{4} = 3 \div 1$ **or** $\frac{3}{4} \div \frac{1}{4} = \frac{3}{4} \times \frac{4}{1}$

$= 3$ $= \frac{3 \times \cancel{4}^{1}}{\cancel{4}_{1} \times 1}$

$= \frac{3}{1}$

$= 3$

If there is $\frac{3}{4}$ of a tank of gas, Roger's father can make 3 trips between the office and the cottage.

b. $\frac{1}{8} \div \frac{1}{4} = \frac{1}{8} \div \frac{2}{8}$ **or** $\frac{1}{8} \div \frac{1}{4} = \frac{1}{8} \times \frac{4}{1}$

$= 1 \div 2$ $= \frac{1 \times \cancel{4}^{1}}{\cancel{8}_{2} \times 1}$

$= \frac{1}{2}$

$= \frac{1}{2}$

If there is $\frac{1}{8}$ of a tank of gas, Roger's father can make $\frac{1}{2}$ of a trip between the office and the cottage.

c. $\frac{1}{2} \div \frac{1}{4} = \frac{2}{4} \div \frac{1}{4}$ **or** $\frac{1}{2} \div \frac{1}{4} = \frac{1}{2} \times \frac{4}{1}$

$= 2 \div 1$ $= \frac{1 \times \cancel{4}^{2}}{\cancel{2}_{1} \times 1}$

$= 2$

$= \frac{2}{1}$

$= 2$

If there is $\frac{1}{2}$ of a tank of gas, Roger's father can make 2 trips between the office and the cottage.

9. a. $\frac{5}{8} \div \frac{1}{8} = 5$ **b.** $\frac{1}{3} \div \frac{2}{3} = \frac{1}{2}$ **c.** $\frac{7}{12} \div \frac{5}{12} = \frac{7}{5} = 1\frac{2}{5}$

d. $\frac{2}{3} \div 2 = \frac{1}{3}$ **e.** $\frac{5}{6} \div 5 = \frac{1}{6}$ **f.** $\frac{4}{5} \div 2 = \frac{2}{5}$

g. $\frac{3}{5} \div \frac{1}{2} = \frac{6}{5} = 1\frac{1}{5}$ **h.** $\frac{1}{2} \div \frac{1}{4} = 2$ **i.** $\frac{2}{3} \div \frac{1}{6} = 4$

10. a. $2\frac{1}{2} \div \frac{5}{8} = \frac{5}{2} \div \frac{5}{8}$ **or** $2\frac{1}{2} \div \frac{5}{8} = \frac{5}{2} \div \frac{5}{8}$

$= \frac{20}{8} \div \frac{5}{8}$ $= \frac{5}{2} \times \frac{8}{5}$

$= 20 \div 5$ $= \frac{\overset{1}{5} \times \overset{4}{\cancel{8}}}{\cancel{2}_{1} \times \underset{1}{5}}$

$= 4$

$= \frac{4}{1}$

$= 4$

b. $6\frac{1}{2} \div 1\frac{3}{4} = \frac{13}{2} \div \frac{7}{4}$ **or** $6\frac{1}{2} \div 1\frac{3}{4} = \frac{13}{2} \div \frac{7}{4}$

$= \frac{26}{4} \div \frac{7}{4}$ $= \frac{13}{2} \times \frac{4}{7}$

$= 26 \div 7$ $= \frac{13 \times \cancel{4}^{2}}{\cancel{2}_{1} \times 7}$

$= \frac{26}{7}$ $= \frac{26}{7}$

$= 3\frac{5}{7}$ $= 3\frac{5}{7}$

c. $8\frac{2}{3} \div 1\frac{1}{3} = \frac{26}{3} \div \frac{4}{3}$ **or** $8\frac{2}{3} \div 1\frac{1}{3} = \frac{26}{3} \div \frac{4}{3}$

$= 26 \div 4$ $= \frac{26}{3} \times \frac{3}{4}$

$= \frac{26}{4}$ $= \frac{\cancel{26}^{13} \times \cancel{3}^{1}}{\cancel{3}_{1} \times \cancel{4}_{2}}$

$= 6\frac{2}{4}$ $= \frac{13}{2}$

$= 6\frac{1}{2}$ $= 6\frac{1}{2}$

11. $7\frac{1}{2} \div 1\frac{1}{4} = \frac{15}{2} \div \frac{5}{4}$ **or** $7\frac{1}{2} \div 1\frac{1}{4} = \frac{15}{2} \div \frac{5}{4}$

$= \frac{30}{4} \div \frac{5}{4}$ $= \frac{15}{2} \times \frac{4}{5}$

$= 30 \div 5$ $= \frac{\cancel{15}^{3} \times \cancel{4}^{2}}{\cancel{2}_{1} \times \cancel{5}_{1}}$

$= 6$ $= \frac{6}{1}$

$= 6$

Orville can glue down 6 tiles.

12. How's Business?
The tailor said, "Mine is ONLY • SEW • SEW."
The garbage collector said, "Mine is PICKING • UP."
The author said, "Mine is ALL • WRITE."
The refrigerator salesperson said, "Mine is NOT • SO • HOT."

13.

$3\frac{3}{4}$	$3\frac{7}{8}$	$\frac{8}{21}$	3	$\frac{2}{9}$
$2\frac{3}{25}$	6	$1\frac{5}{6}$	$1\frac{1}{9}$	$1\frac{17}{25}$
$3\frac{1}{3}$	$2\frac{5}{9}$	$\frac{9}{16}$	$2\frac{1}{3}$	$2\frac{1}{2}$
$\frac{15}{16}$	$1\frac{4}{5}$	7	$1\frac{7}{8}$	$\frac{2}{3}$
$\frac{8}{9}$	$\frac{1}{4}$	$4\frac{1}{8}$	$1\frac{7}{12}$	$1\frac{3}{4}$

14. a. $\frac{\frac{2}{7}}{\frac{5}{7}} = \frac{2}{7} \div \frac{5}{7}$ **or** $\frac{\frac{2}{7}}{\frac{5}{7}} = \frac{2}{7} \div \frac{5}{7}$

$= \frac{2}{7} \times \frac{7}{5}$ $= 2 \div 5$

$= \frac{2 \times \overset{1}{\cancel{7}}}{\underset{1}{\cancel{7}} \times 5}$ $= \frac{2}{5}$

$= \frac{2}{5}$

Note: You could also use a calculator.

b. $\frac{\frac{1}{3}}{\frac{3}{4}} = \frac{1}{3} \div \frac{3}{4}$ **or** $\frac{\frac{1}{3}}{\frac{3}{4}} = \frac{1}{3} \div \frac{3}{4}$

$= \frac{1}{3} \times \frac{4}{3}$ $= \frac{4}{12} \div \frac{9}{12}$

$= \frac{1 \times 4}{3 \times 3}$ $= 4 \div 9$

$= \frac{4}{9}$ $= \frac{4}{9}$

Note: You could also use a calculator.

c. $\frac{\frac{3}{4}}{\frac{1}{2}} = \frac{3}{4} \div \frac{1}{2}$ **or** $\frac{\frac{3}{4}}{\frac{1}{2}} = \frac{3}{4} \div \frac{1}{2}$

$= \frac{3}{4} \times \frac{2}{1}$ $= \frac{3}{4} \div \frac{2}{4}$

$= \frac{3 \times \overset{1}{\cancel{2}}}{\underset{2}{\cancel{4}} \times 1}$ $= 3 \div 2$

$= \frac{3}{2}$ $= \frac{3}{2}$

$= 1\frac{1}{2}$ $= 1\frac{1}{2}$

Note: You could also use a calculator.

Now Try This

15. Use a table to eliminate clues and solve the problem.

	Time waited after starting signal	Time it took to run 1 km	Total time
Bear	0 min	$2\frac{1}{4}$ min	$2\frac{1}{4}$ min
Giraffe	$\frac{5}{8}$ min	$1\frac{3}{4}$ min	$2\frac{3}{8}$ min
Monkey	1 min	$1\frac{1}{8}$ min	$2\frac{1}{8}$ min
Rabbit	$\frac{2}{3}$ min	$1\frac{13}{24}$ min	$2\frac{5}{24}$ min
Dog	$\frac{1}{4}$ min	$1\frac{1}{2}$ min	$1\frac{3}{4}$ min

a. Use the total time to determine the order in which the animals finished the race.

- The dog won the race.
- The monkey came in second.
- The rabbit came in third.
- The giraffe came in last.

b. Use the time it took to run 1 km to determine the speed of the animals.

- The monkey ran the fastest.
- The dog ran the second fastest.
- The rabbit ran the third fastest.
- The bear ran the slowest.

16. One-third of the 6 coins are dimes; therefore, 2 of the coins are dimes $\left(\frac{1}{3}\times 6 = 2\right)$. These 2 coins are worth one-fourth of the value of these coins. Ask yourself, "One-fourth of what is 20¢?" The answer is 80¢. If the value of the 2 dimes is 20¢, the value of the other 4 coins is 60¢ $(80 - 20 = 60)$.

Use the guess, check, and revise strategy to determine the coins Fran has.

Fran has 2 dimes, 2 quarters, and 2 nickels.

17. You may need to change your point of view to solve this problem. **Note:** The perimeter of this figure is 24 units.

Section 1: Follow-up Activities

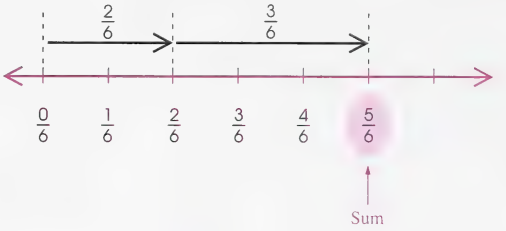
Extra Help

1. a. $\frac{1}{3}+\frac{1}{2}=\frac{2}{6}+\frac{3}{6}$

$=\frac{5}{6}$

During these two days, $\frac{5}{6}$ of the house was painted.

Following is a number line which illustrates the problem.

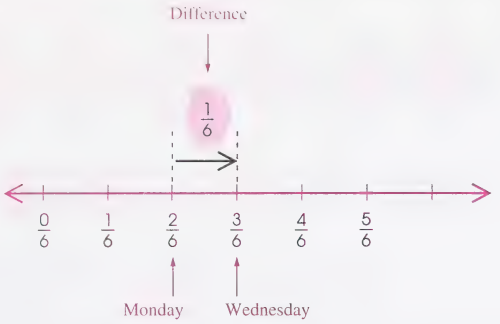


b. $\frac{1}{2}-\frac{1}{3}=\frac{3}{6}-\frac{2}{6}$

$=\frac{1}{6}$

Alvin painted $\frac{1}{6}$ more on Wednesday than on Monday.

Following is a number line which illustrates the problem.

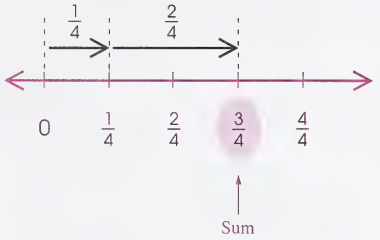


2. a. $\frac{1}{4}+\frac{1}{2}=\frac{1}{4}+\frac{2}{4}$

$=\frac{3}{4}$

The group earned $\frac{3}{4}$ of the money in the two fund-raisers.

Following is a number line which illustrates the problem.

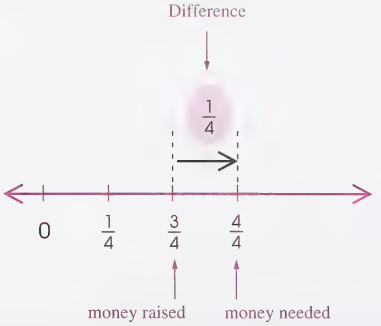


b. $1-\frac{3}{4}=\frac{4}{4}-\frac{3}{4}$

$=\frac{1}{4}$

The youth group needs to raise $\frac{1}{4}$ of the money.

Following is a number line which illustrates the problem.

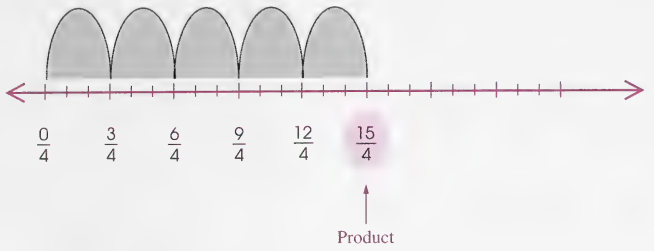


3. a. $5\times\frac{3}{4}=\frac{15}{4}$

$=3\frac{3}{4}$

Louis practises for $3\frac{3}{4}$ h.

Following is a number line which illustrates the problem.

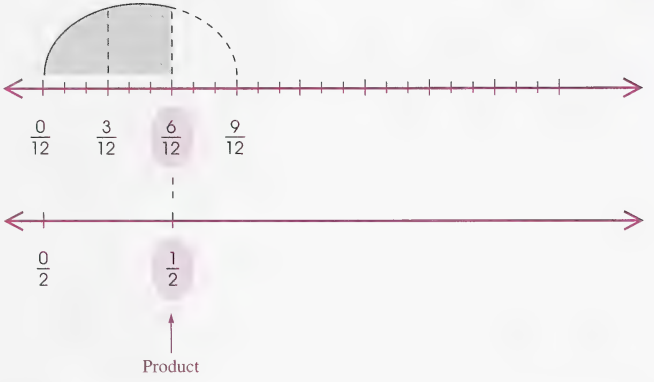


b. $\frac{2}{3} \times \frac{3}{4} = \frac{6}{12}$

$= \frac{1}{2}$

Lucinda spent $\frac{1}{2}$ h waiting for the bus.

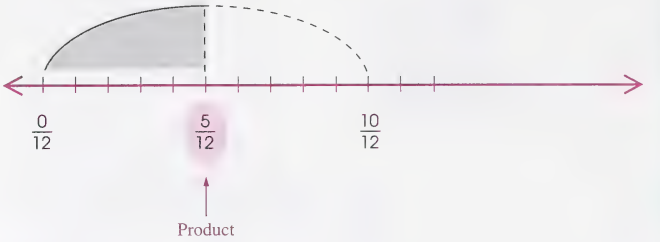
Following is a number line which illustrates the problem.



c. $\frac{1}{2} \times \frac{5}{6} = \frac{5}{12}$

Steve ran the race in $\frac{5}{12}$ h this year.

Following is a number line which illustrates the problem.



4. a. $\frac{1}{3} \div \frac{1}{6} = \frac{2}{6} \div \frac{1}{6}$

$= 2 \div 1$

$= \frac{2}{1}$

$= 2$

or $\frac{1}{3} \div \frac{1}{6} = \frac{1}{3} \times \frac{6}{1}$

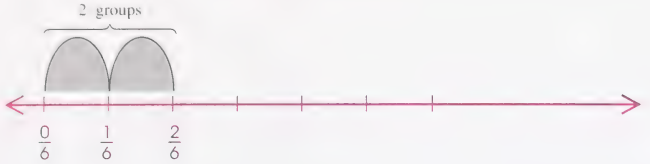
$= \frac{1 \times \overset{2}{\cancel{6}}}{\underset{1}{\cancel{3}} \times 1}$

$= \frac{2}{1}$

$= 2$

In this portion of the pie, there are 2 pieces of this size.

Following is a number line which illustrates the problem.



b. $\frac{1}{3} \div \frac{1}{4} = \frac{4}{12} \div \frac{3}{12}$ **or** $\frac{1}{3} \div \frac{1}{4} = \frac{1}{3} \times \frac{4}{1}$

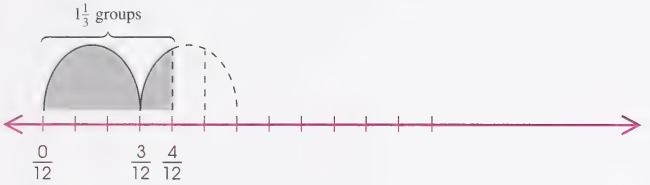
$= 4 \div 3$ $= \frac{1 \times 4}{3 \times 1}$

$= \frac{4}{3}$ $= \frac{4}{3}$

$= 1\frac{1}{3}$ $= 1\frac{1}{3}$

In this portion of the pie, there are $1\frac{1}{3}$ pieces of this size.

Following is a number line which illustrates the problem.



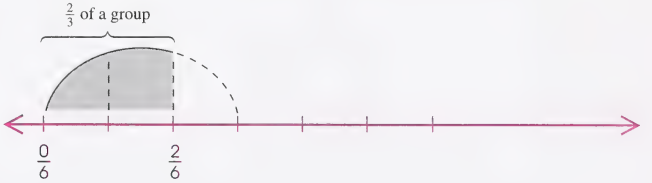
c. $\frac{1}{3} \div \frac{1}{2} = \frac{2}{6} \div \frac{3}{6}$ **or** $\frac{1}{3} \div \frac{1}{2} = \frac{1}{3} \times \frac{2}{1}$

$= 2 \div 3$ $= \frac{1 \times 2}{3 \times 1}$

$= \frac{2}{3}$ $= \frac{2}{3}$

In this portion of the pie, there is $\frac{2}{3}$ of a piece of this size.

Following is a number line which illustrates the problem.



Enrichment

1. a.

$3\frac{1}{3}$	$1\frac{2}{3}$	4
$3\frac{2}{3}$	3	$2\frac{1}{3}$
2	$4\frac{1}{3}$	$2\frac{2}{3}$

The magic sum is 9.

b.

1	$2\frac{1}{4}$	$\frac{1}{2}$
$\frac{3}{4}$	$1\frac{1}{4}$	$1\frac{3}{4}$
2	$\frac{1}{4}$	$1\frac{1}{2}$

The magic sum is $3\frac{3}{4}$.

2. a.

$\frac{2}{3}$	$\frac{1}{3}$	$1\frac{1}{3}$
1	$1\frac{2}{3}$	$2\frac{1}{3}$
2	3	$2\frac{2}{3}$

The magic difference is $1\frac{2}{3}$.

b.

$\frac{1}{2}$	$\frac{1}{4}$	1
$\frac{3}{4}$	$1\frac{1}{4}$	$1\frac{3}{4}$
$1\frac{1}{2}$	$2\frac{1}{4}$	2

The magic difference is $1\frac{1}{4}$.

Section 2: Activity 1

1. Answers may vary. Following are the simplest models. Other models are possible if zero pairs are added.

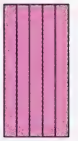
a. 

b. 

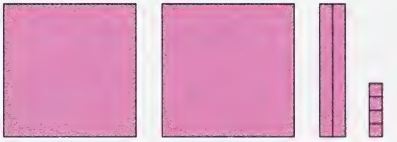
c. 

d. 

2. a. 0 **b.** +2 **c.** −1

3. a. 

b. 

c. 

4. a. −1.2 **b.** +1.54 **c.** 0 **d.** +0.2

5. a. −975.37 **b.** +649.98

6. a. On the chart, Goose Bay has the lowest average low temperature.

b. On the chart, Halifax has the highest average high temperature.

7. a. On the chart, silver has the highest melting point.
b. On the chart, mercury has the lowest melting point.

8. **a.** Of the stocks on the chart, Biomira had the greatest decrease.

b. Of the stocks on the chart, Telus had the greatest increase.

c. Of the stocks on the chart, the only stock that had no change was Newalta.

9.

Positive	Negative
up	down
right	left
east	west
north	south

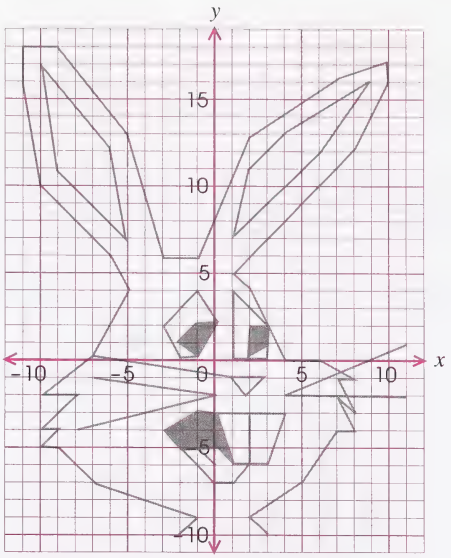
10. **a.** +32.5

b. −12.8

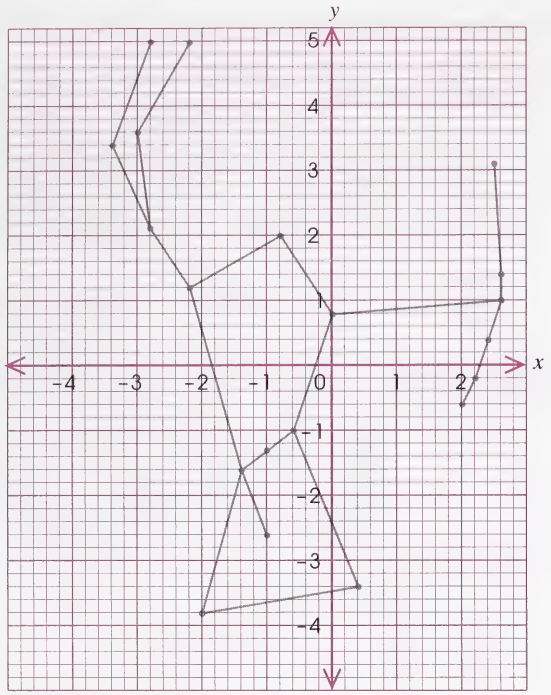
c. −50

d. +4

11. Puzzle 1 should look similar to the following.



12. a.

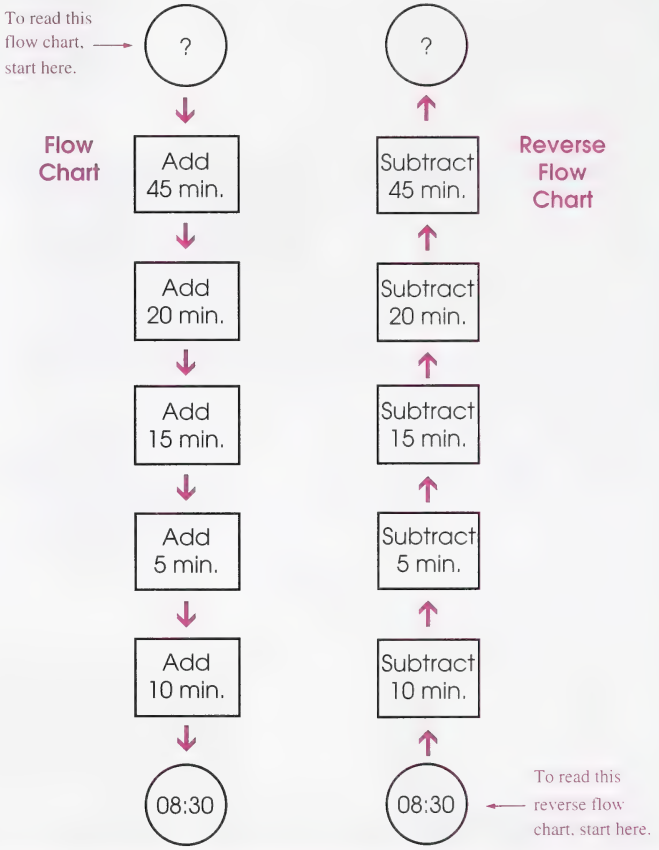


b. Puzzle 2 represents the constellation of Orion, the hunter.

Now Try This

13. To solve this problem work backwards.

Step 1: Make a flow chart and a reverse flow chart.



Step 2: Use the reverse flow chart to solve the problem.

Sid must get up by 06:55.

14. a. Edward Samuel Rogers invented the "batteryless" radio.

b. Rogers' radio was so good that it was a commercial success despite its high cost.

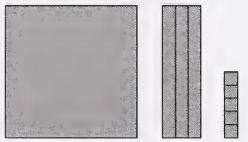
Rogers started a radio station and got one of the first licences to transmit television.

Section 2: Activity 2

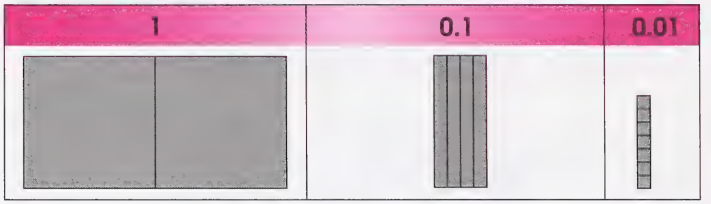
1. a.
$$\begin{array}{r} 1.12 \\ +\ 1.35 \\ \hline 2.47 \end{array}$$

Note: Following is an explanation of how base ten blocks can be used to model the sum.


represents 1.12.


represents 1.35.

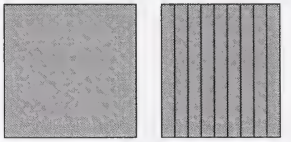
Combine the models of 1.12 and 1.35.

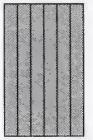


The result is 2 flats, 4 longs, and 7 small cubes. This represents 2.47.

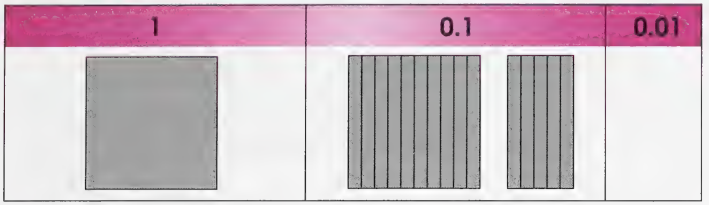
b.
$$\begin{array}{r} {\scriptstyle 1} \\ 1.9 \\ +\ 0.6 \\ \hline 2.5 \end{array}$$
← Regrouping may be done mentally.

Note: Following is an explanation of how base ten blocks can be used to model the sum.

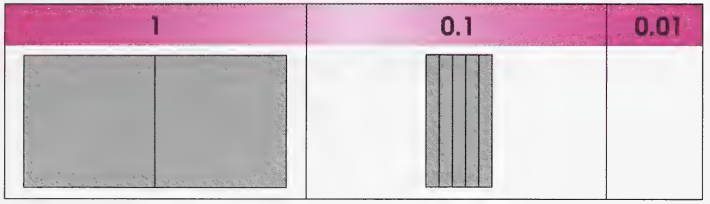

represents 1.9.


represents 0.6.

Step 1: Combine the models of 1.9 and 0.6.



Step 2: Trade 10 longs for 1 flat.



The result is 2 flats and 5 longs. This represents 2.5.

2.
$$\begin{array}{r} {\scriptstyle 1\ 1} \\ 35.99 \\ +\ 2.49 \\ \hline 38.48 \end{array}$$
← Regrouping may be done mentally.

The total cost of Rachel's purchases was $38.48.

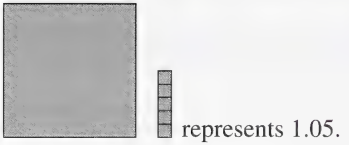
3.
$$\begin{array}{r} {\scriptstyle 1} \\ 42.76 \\ +\ 43.18 \\ \hline 85.94 \end{array}$$
← Regrouping may be done mentally.

The skater's time for two laps was 85.94 s.

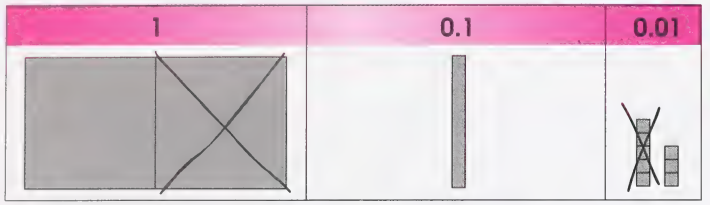
4. a.
$$\begin{array}{r} 2.18 \\ -\ 1.05 \\ \hline 1.13 \end{array}$$

Note: Following is an explanation of how base ten blocks can be used to model the difference.


represents 2.18.


represents 1.05.

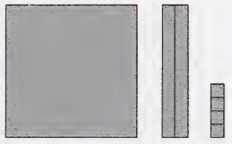
Remove the model of 1.05 from 2.18.



The result is 1 flat, 1 long, and 3 small cubes. This represents 1.13.

b. 1 14 ← Regrouping may be done mentally.

$$\begin{array}{r} 1.\cancel{2}\,\cancel{1}4 \\ -\ 0.1\,5 \\ \hline 1.0\,9 \end{array}$$



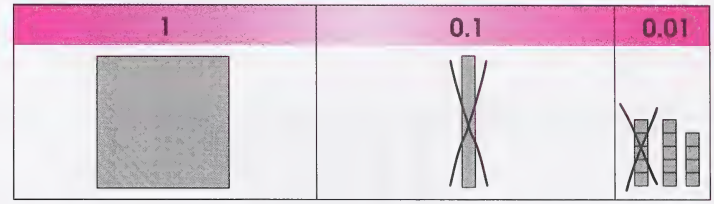
represents 1.24.

represents 0.15.

Note: Following is an explanation of how base ten blocks can be used to model the difference.

Step 1: You cannot remove the model of 0.15 from 1.24. Therefore, in the model of 1.24, trade 1 long for 10 small cubes.

Step 2: Remove the model of 0.15 from 1.24.



The result is 1 flat and 9 small cubes. This represents 1.09.

5. 11 1 14 ← Regrouping may be done mentally.

$$\begin{array}{r} \cancel{1}\,\cancel{2}\,\cancel{1}4.99 \\ -\ 6\,9.98 \\ \hline 5\,5.01 \end{array}$$

The coat was reduced by $55.01.

6. 3 16 ← Regrouping may be done mentally.

$$\begin{array}{r} 146.7 \\ -\ \ 9.4 \\ \hline 137.3 \end{array}$$

The Great Pyramid is now about 137.3 m tall.

7. a. $(+8)+(+5)=+(8+5)$

$=+13$

Note: Following is an explanation of how counters can be used to model the sum.

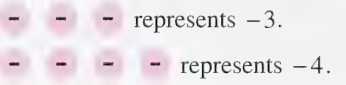
Combine the models of $+8$ and $+5$.

The result is 13 positive counters. This represents $+13$.

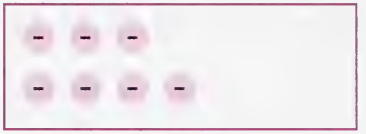
b. $(-3)+(-4)=-(3+4)$

$=-7$

Note: Following is an explanation of how counters can be used to model the sum.



Combine the models of -3 and -4.

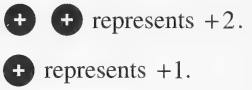


The result is 7 negative counters. This represents -7.

c.

$$\begin{array}{r} (+2) \\ +\ (+1) \\ \hline +3 \end{array}$$

Note: Following is an explanation of how counters can be used to model the sum.



Combine the models of $+2$ and $+1$.

The result is 3 positive counters. This represents $+3$.

d.
$$\begin{array}{r} (-5) \\ +\ (-3) \\ \hline -8 \end{array}$$

Note: Following is an explanation of how counters can be used to model the sum.

 represents -5.

 represents -3.

Combine the models of -5 and -3.

The result is 8 negative counters. This represents -8.

8. a. $(+3)+(+5)=+(3+5)$ **or**
$$\begin{array}{r} +3 \\ +\ (+5) \\ \hline +(3+5)=+8 \end{array}$$
$=+8$

The total in Rita's bank increased by \$8.

b. $(-2)+(-8)=-(2+8)$ **or**
$$\begin{array}{r} -2 \\ +\ (-8) \\ \hline -(2+8)=-10 \end{array}$$
$=-10$

The total in Rita's bank decreased by \$10.

9. a. $(+5)+(-4)=+(5-4)$
$=+1$

Note: Following is an explanation of how counters can be used to model the addition.

 represents $+5$.

 represents -4.

Step 1: Combine the models of $+5$ and -4.

Step 2: Identify and remove any zero pairs.

The result is 1 positive counter. This represents $+1$.

b. $(+6)+(-8)=-(8-6)$

$=-2$

Note: Following is an explanation of how counters can be used to model the addition.

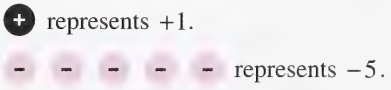
Step 1: Combine the models of $+6$ and -8.

Step 2: Identify and remove any zero pairs.

The result is 2 negative counters. This represents -2.

c.
$$\begin{array}{r} (+1) \\ +\ (-5) \\ \hline -4 \end{array}$$

Note: Following is an explanation of how counters can be used to model the addition.



Step 1: Combine the models of $+1$ and -5.

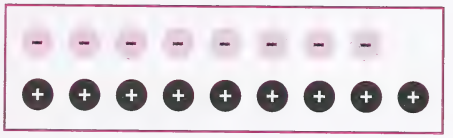
Step 2: Identify and remove any zero pairs.

The result is 4 negative counters. This represents -4.

d.
$$\begin{array}{r} (-8) \\ +\ (+9) \\ \hline +1 \end{array}$$

Note: Following is an explanation of how counters can be used to model the addition.

Step 1: Combine the models of -8 and $+9$.



Step 2: Identify and remove any zero pairs.

The result is 1 positive counter. This represents $+1$.

10. a. $(+3)+(-4)=-(4-3)$ **or**
$$\begin{array}{r} +3 \\ +\ (-4) \\ \hline -(4-3)=-1 \end{array}$$
$=-1$

The car was 1 m behind the starting point.

b. $(+8)+(-3)=+(8-3)$ **or**
$$\begin{array}{r} +8 \\ +\ (-3) \\ \hline +(8-3)=+5 \end{array}$$
$=+5$

The car was 5 m ahead of the starting point.

11. a. $(+8)-(+3)=(+8)+(-3)$
$=+(8-3)$
$=+5$

Note: Following is an explanation of how counters can be used to model the difference.

Remove the model of $+3$ from $+8$.

The result is 5 positive counters. This represents $+5$.

b. $(+5)-(+6)=(+5)+(-6)$

$=-(6-5)$

$=-1$

Note: Following is an explanation of how counters can be used to model the difference.

 represents $+5$.

 represents $+6$.

Step 1: You cannot remove the model of $+6$ from $+5$. Therefore, to the model of $+5$, add a zero pair. (This will not change the value of $+5$.)

Step 2: Remove the model of $+6$ from $+5$.

The result is 1 negative counter. This represents -1.

c. $(-2)-(+3)=(-2)+(-3)$

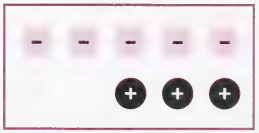
$=-(2+3)$

$=-5$

 represents -2.

 represents $+3$.

Step 1: You cannot remove the model of $+3$ from -2. Therefore, to the model of -2, add sufficient zero pairs. (This will not change the value of -2.)



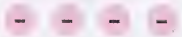
Step 2: Remove the model of $+3$ from -2.

The result is 5 negative counters. This represents -5.

d.
$$\begin{array}{r} +5 \\ -\ (-4) \\ \hline \end{array} = \begin{array}{r} +5 \\ +\ (+4) \\ \hline +(5+4)=+9 \end{array}$$

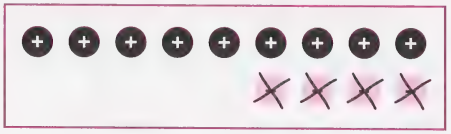
Note: Following is an explanation of how counters can be used to model the difference.

 represents $+5$.

 represents -4.

Step 1: You cannot remove the model of -4 from $+5$. Therefore, to the model of $+5$, add sufficient zero pairs. (This will not change the value of $+5$.)

Step 2: Remove the model of -4 from $+5$.



The result is 9 positive counters. This represents $+9$.

e.
$$\begin{array}{r} (-8) \\ -\ (-3) \\ \hline \end{array} = \begin{array}{r} (-8) \\ +\ (+3) \\ \hline -(8-3)=-5 \end{array}$$

Note: Following is an explanation of how counters can be used to model the difference.

 represents -8.

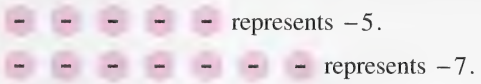
 represents -3.

Remove the model of -3 from -8.

The result is 5 negative counters. This represents -5.

f.
$$\begin{array}{r} (-5) \\ -\ (-7) \\ \hline \end{array} = \begin{array}{r} (-5) \\ +\ (+7) \\ \hline +(7-5)=+2 \end{array}$$

Note: Following is an explanation of how counters can be used to model the difference.



Step 1: You cannot remove the model of -7 from -5. Therefore, to the model of -5, add sufficient zero pairs.

Step 2: Remove the model of -7 from -5.

The result is 2 positive counters. This represents $+2$.

12. $(+7)-(+8)=(+7)+(-8)$ **or**
$$=-(8-7)$$
$$=-1$$

$$\begin{array}{r} +7 \\ -\ (+8) \\ \hline \end{array} = \begin{array}{r} +7 \\ +\ (-8) \\ \hline -(8-7)=-1 \end{array}$$

The price of the stock dropped \$1.

13. $(-8)-(+20)=(-8)+(-20)$
$$=-(8+20)$$
$$=-28$$

or

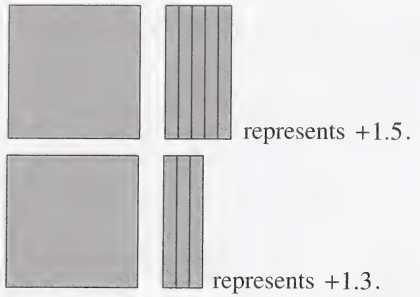
$$\begin{array}{r} -8 \\ -\ (+20) \\ \hline \end{array} = \begin{array}{r} -8 \\ +\ (-20) \\ \hline -(8+20)=-28 \end{array}$$

Jett experiences a drop of 28°C when he goes outside.

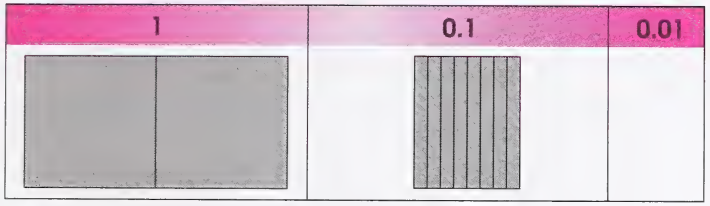
14. a. $(+1.5)+(+1.3)=+(1.5+1.3)$

$=+2.8$

Note: Following is an explanation of how base ten blocks can be used to model the sum.



Combine the models of +1.5 and +1.3.

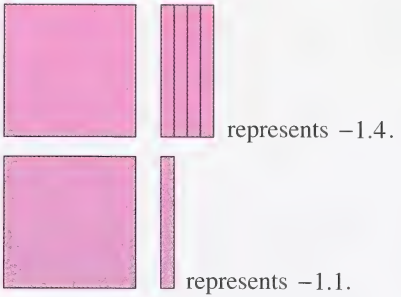


The result is 2 flats and 8 longs. All the blocks are positive. This represents +2.8.

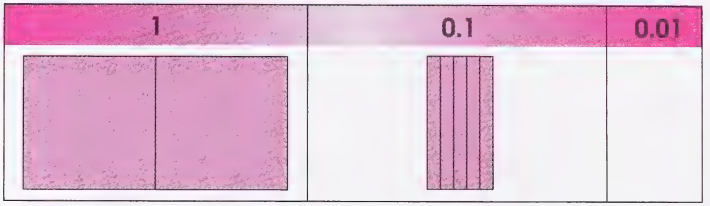
b. $(-1.4)+(-1.1)=-(1.4+1.1)$

$=-2.5$

Note: Following is an explanation of how base ten blocks can be used to model the sum.



Combine the models of −1.4 and −1.1.

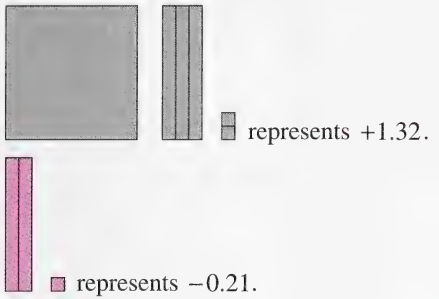


The result is 2 flats and 5 longs. All the blocks are negative. This represents −2.5.

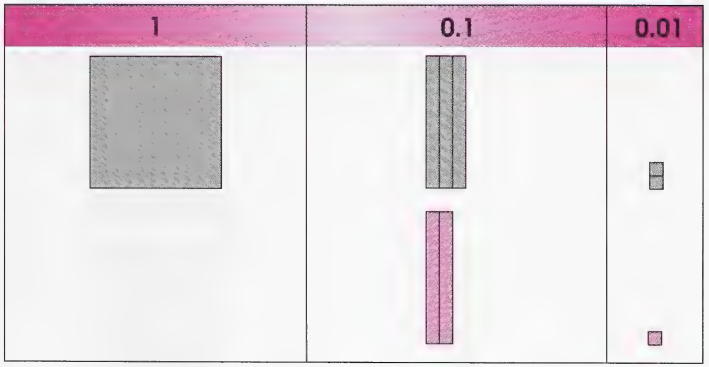
c. $(+1.32)+(-0.21)=+(1.32-0.21)$

$=+1.11$

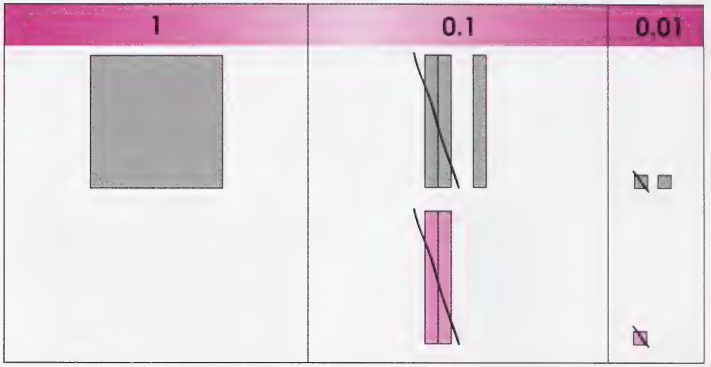
Note: Following is an explanation of how base ten blocks can be used to model the sum.



Step 1: Combine the models of $+1.32$ and -0.21.



Step 2: Identify and remove any zero pairs.

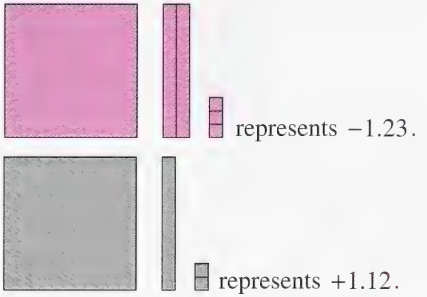


The result is 1 flat, 1 long, and 1 small cube. All the blocks are positive. This represents $+1.11$.

d. $(-1.23)+(+1.12)=-(1.23-1.12)$

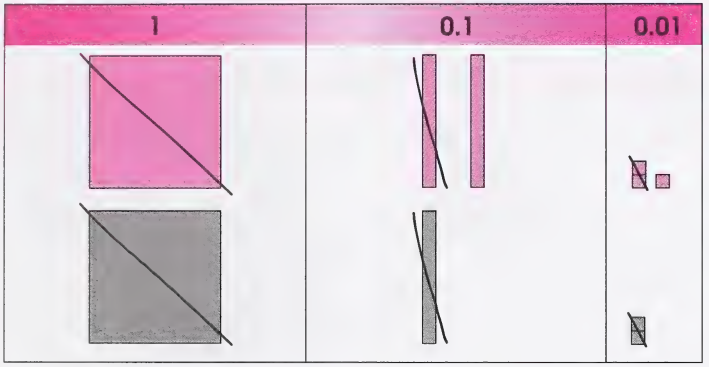
$=-0.11$

Note: Following is an explanation of how base ten blocks can be used to model the sum.



Step 1: Combine the models of -1.23 and $+1.12$.

Step 2: Identify and remove any zero pairs.

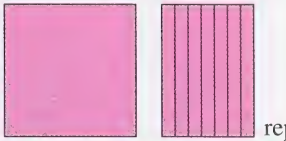


The result is 1 long and 1 small cube. The blocks are all negative. This represents -0.11.

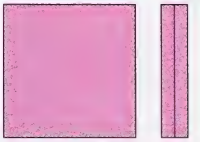
e.

$$\begin{array}{r} (-1.7) \\ +\ (-1.2) \\ \hline -(1.7+1.2)=-2.9 \end{array}$$

Note: Following is an explanation of how base ten blocks can be used to model the sum.

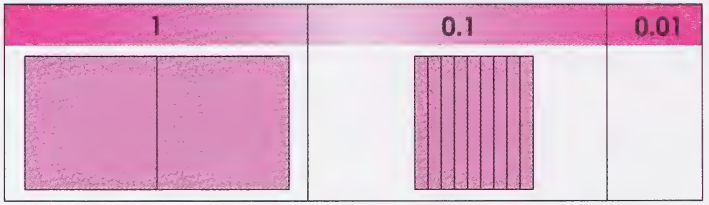


represents -1.7.



represents -1.2.

Step 1: Combine the models of -1.7 and -1.2.



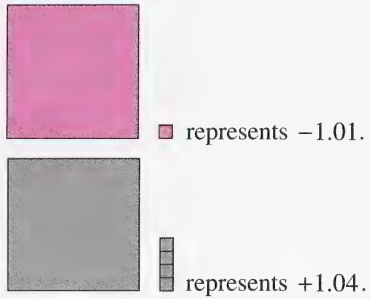
The result is 2 flats, and 9 longs. All the blocks are negative. This represents -2.9.

f. (-1.01)

$+\ (+1.04)$

$+(1.04-1.01)=+0.03$

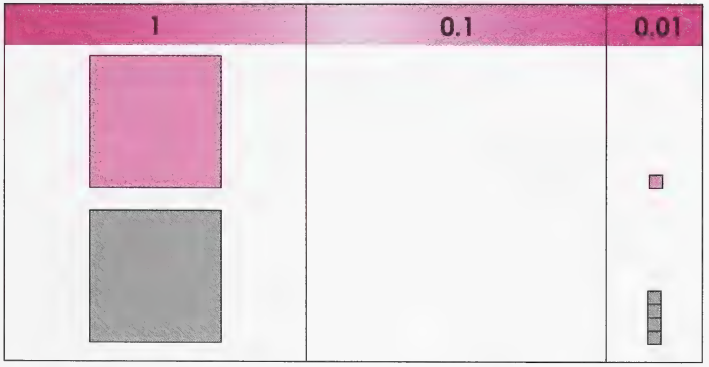
Note: Following is an explanation of how base ten blocks can be used to model the difference.



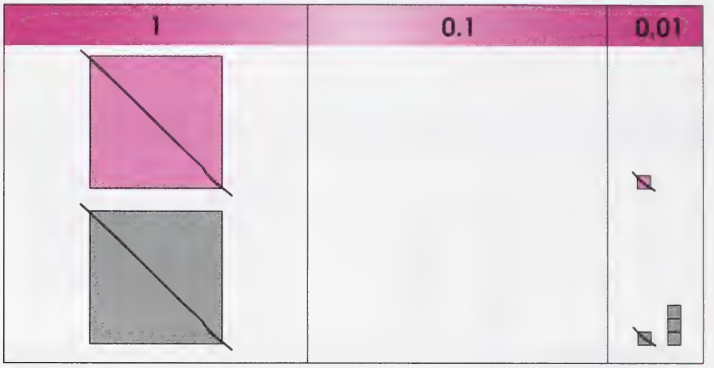
represents -1.01.

represents $+1.04$.

Step 1: Combine the models of -1.01 and $+1.04$.



Step 2: Identify and remove any zero pairs.



The result is 3 small cubes. All the blocks are positive. This represents $+0.03$.

15. $(+4.75)+(-0.05)=+(4.75-0.05)$

$=+4.70$

or

$+4.75$

$+\ (-0.05)$

$+(4.75-0.05)=+4.70$

The closing price that day was \$4.70.

16. $(+8.5)+(-10.5)=-(10.5-8.5)$ **or**

$=-2$

$$\begin{array}{r} +8.5 \\ +\ (-10.5) \\ \hline -(10.5-8.5)=-2 \end{array}$$

Kristy travelled 2 km west of the starting point.

17. $(+4.2)+(-10.5)=-(10.5-4.2)$ **or**

$=-6.3$

$$\begin{array}{r} +4.2 \\ +\ (-10.5) \\ \hline -(10.5-4.2)=-6.3 \end{array}$$

The temperature in Fort McMurray is $-6.3°C$.

18. $(-85.9)+(+110.9)=+(110.9-85.9)$

$=+25$

or

$$\begin{array}{r} -85.9 \\ +\ (+110.9) \\ \hline +(110.9-85.9)=+25 \end{array}$$

Rick's new position is 25 m above sea level.

19. a. $(-0.5)-(-0.2)=(-0.5)+(+0.2)$

$=-(0.5-0.2)$

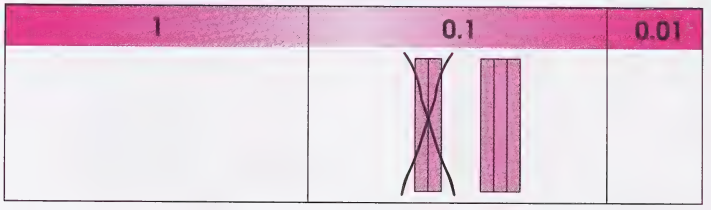
$=-0.3$

Note: Following is an explanation of how base ten blocks can be used to model the difference.

represents -0.5.

represents -0.2.

Remove the model of -0.2 from -0.5.



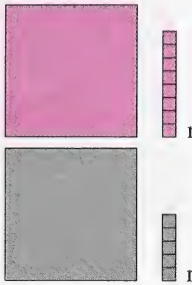
The result is 3 negative longs. This represents -0.3.

b. $(-1.08)-(+1.05)=(-1.08)+(-1.05)$

$=-(1.08+1.05)$

$=-2.13$

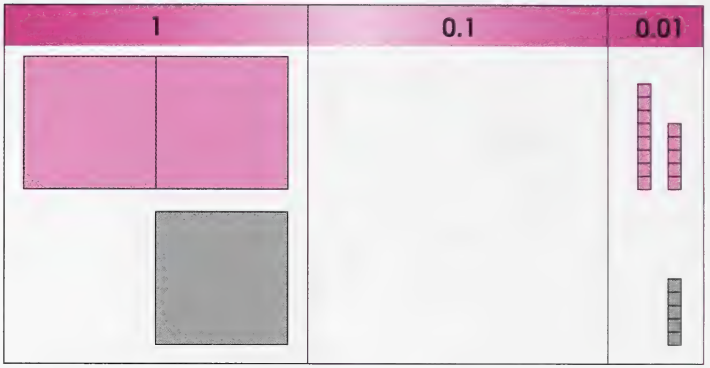
Note: Following is an explanation of how base ten blocks can be used to model the difference.



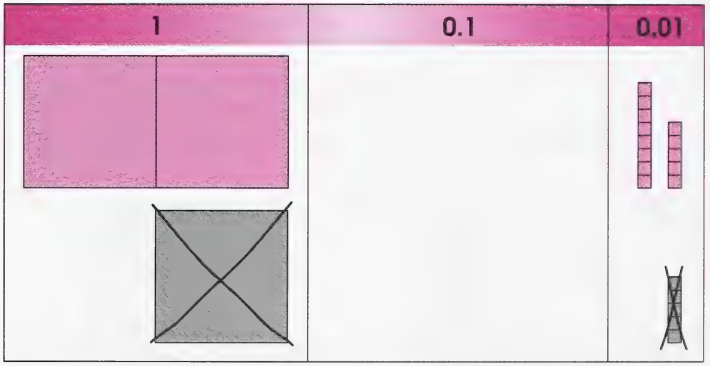
represents -1.08.

represents $+1.05$.

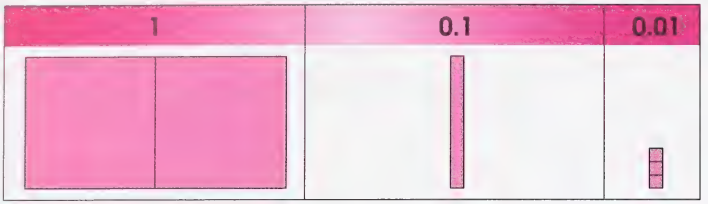
Step 1: You cannot remove the model of $+1.05$ from -1.08. Therefore, to the model of -1.08, add sufficient zero pairs. (This will not change the value of -1.08.)



Step 2: Remove the model of $+1.05$ from -1.08.

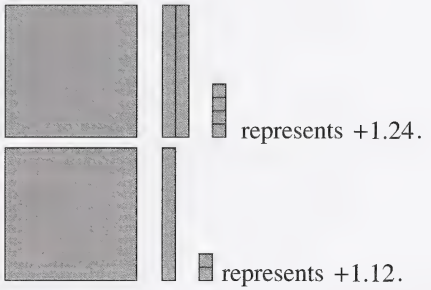


Step 3: To simplify, trade 10 small cubes for 1 long.

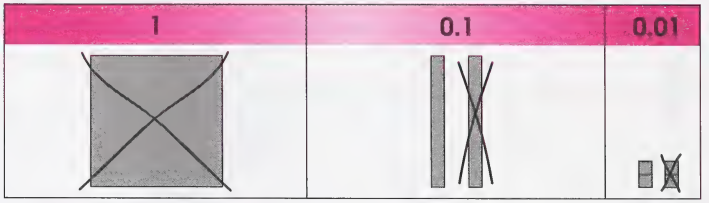


The result is 2 flats, 1 long, and 3 small cubes. All the blocks are negative. This represents -2.13.

c.
$$\begin{array}{r} (+1.24) \\ -\ (+1.12) \\ \hline \end{array} = \begin{array}{r} (+1.24) \\ +\ (-1.12) \\ \hline +(1.24-1.12)=+0.12 \end{array}$$

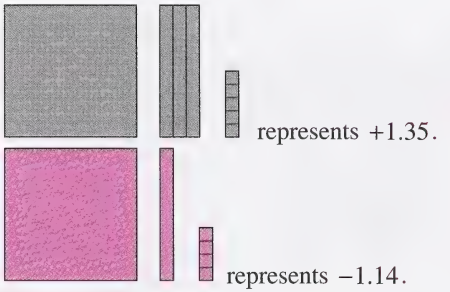


Remove the model of $+1.12$ from $+1.24$.

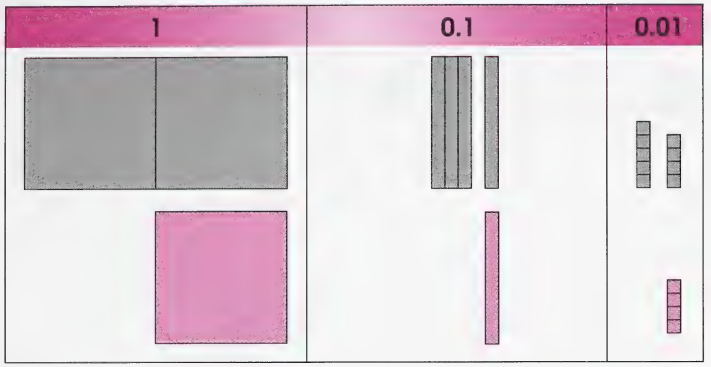


The result is 1 long and 2 small cubes. All the blocks are positive. This represents $+0.12$.

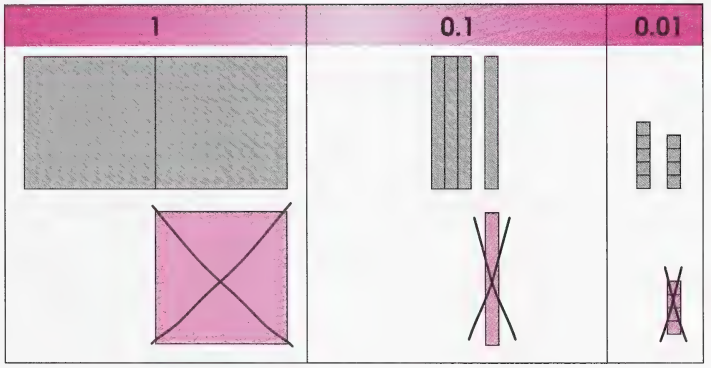
d.
$$\begin{array}{r} (+1.35) \\ -\ (-1.14) \\ \hline \end{array} = \begin{array}{r} (+1.35) \\ +\ (+1.14) \\ \hline +(1.35+1.14)=+2.49 \end{array}$$



Step 1: You cannot remove the model of -1.14 from $+1.35$. Therefore, to the model of $+1.35$, add sufficient zero pairs.



Step 2: Remove -1.14 from $+1.35$.

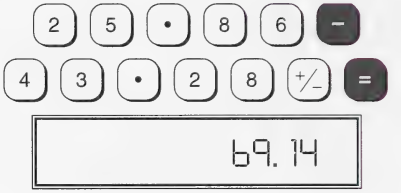


The result is 2 flats, 4 longs, and 9 small cubes. All the blocks are positive. This represents $+2.49$.

20. Step 1: Estimate the answer.

$$(+25.86)-(-43.28) \doteq (+30)-(-40)$$
$$\doteq (+30)+(+40)$$
$$\doteq +70$$

Step 2: Press the following key sequence.



Step 3: Compare the estimate and the calculated answer.

$69.14 \doteq +70$

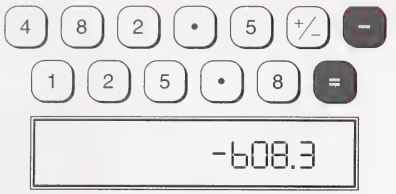
So, the answer is reasonable.

The bank account balance increased by \$69.14.

21. Step 1: Estimate the answer.

$$(-482.5)-(+125.8) \doteq (-500)-(+100)$$
$$\doteq (-500)+(-100)$$
$$\doteq -600$$

Step 2: Press the following key sequence.



Step 3: Compare the estimate to the calculated answer.

$$-608.3 \doteq -600$$

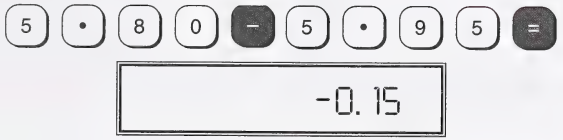
So, the answer is reasonable.

The miners descended 608.3 m.

22. **Step 1:** Estimate the answer.

$$\begin{aligned}(+5.80)-(+5.95) &= (+6)-(+6)\\ &= (+6)+(-6)\\ &= 0\end{aligned}$$

Step 2: Press the following key sequence.



Step 3: Compare the estimate and the calculated answer.

$$-0.15 \doteq 0$$

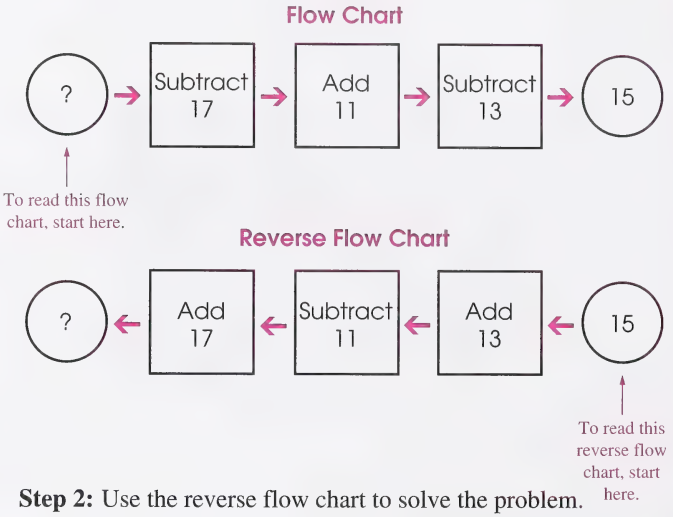
So, the answer is reasonable.

The price dropped \$0.15.

Now Try This

23. To solve this problem, you can work backwards.

Step 1: Make a flow chart and a reverse flow chart.

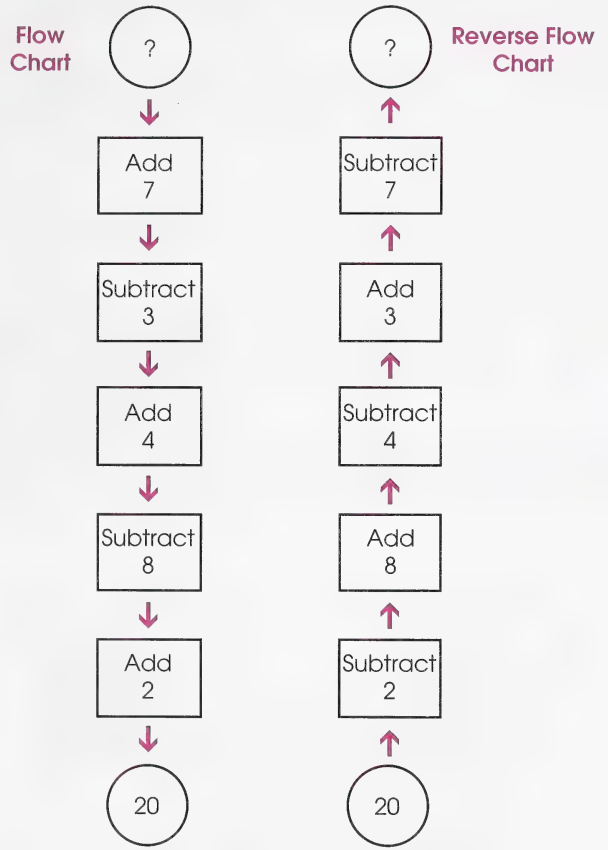


Step 2: Use the reverse flow chart to solve the problem.

The teacher had 34 pencils at the start of the day.

24. To solve this problem, you can work backwards.

Step 1: Make a flow chart and a reverse flow chart.

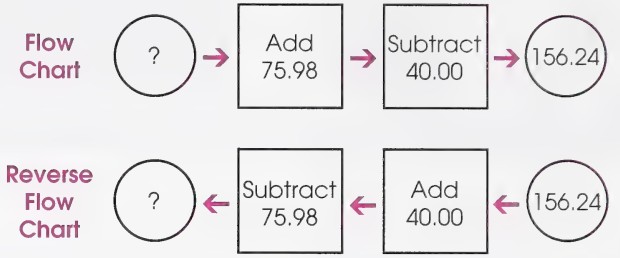


Step 2: Use the reverse flow chart to solve the problem.

The burglar got on the elevator at Floor 18.

25. To solve this problem, you can work backwards.

Step 1: Make a flow chart and a reverse flow chart.



Step 2: Use the reverse flow chart to solve the problem.

There was a balance of $120.26 before the transactions.

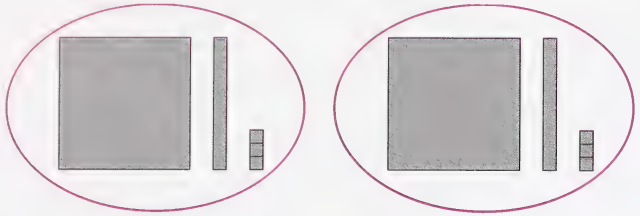
Section 2: Activity 3

1. a.
$$\begin{array}{r} 1.13 \\ \times \quad 2 \\ \hline 2.26 \end{array}$$

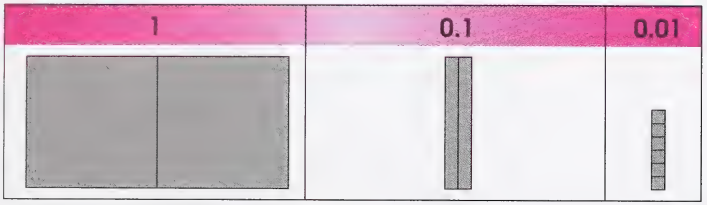
The expression 2×1.13 means 2 groups of 1.13.

Note: Following is an explanation of how to use base ten blocks to model the product.

Step 1: To model the product, show 2 groups of 1.13.



Step 2: Combine the groups.



The result is 2 flats, 2 longs, and 6 small cubes. This represents 2.26.

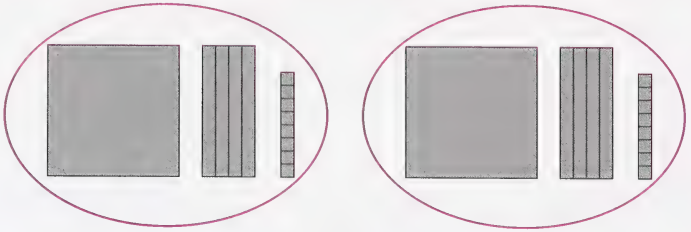
b.

$$\begin{array}{r} 1.48 \\ \times \quad 2 \\ \hline 2.96 \end{array}$$

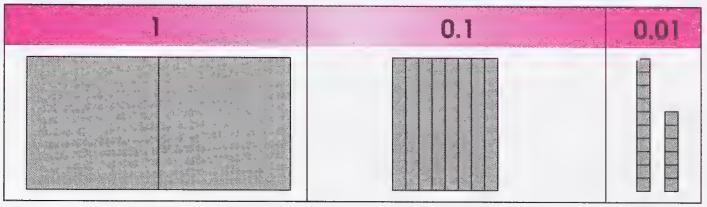
The expression 2×1.48 means 2 groups of 1.48.

Note: Following is an explanation of how base ten blocks can be used to model the product.

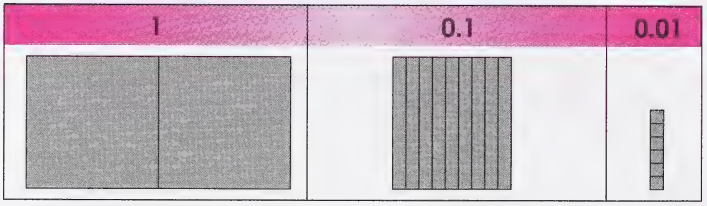
Step 1: To model the product, show 2 groups of 1.48.



Step 2: Combine the groups.



Step 3: Trade 10 small cubes for 1 long.



The result is 2 flats, 9 longs, and 6 small cubes. This represents 2.96.

c.

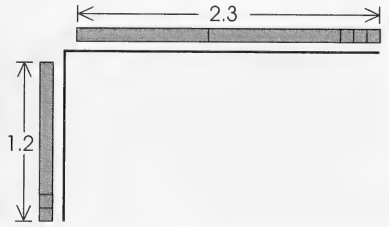
$$\begin{array}{rl} 2.3 & \leftarrow \text{1 decimal place} \\ \times\ 1.2 & \leftarrow \text{1 decimal place} \\ \hline 46 & \\ 23 & \\ \hline 2.76 & \leftarrow \text{2 decimal places} \end{array}$$

1 decimal place
+ 1 decimal place
2 decimal places

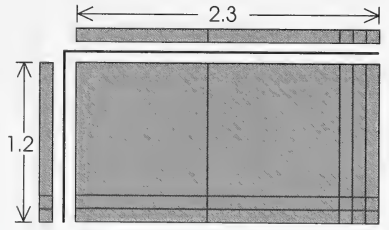
Note: Following is an explanation of how base ten blocks can be used to model the product.

You can think of 1.2×2.3 as a rectangular array.

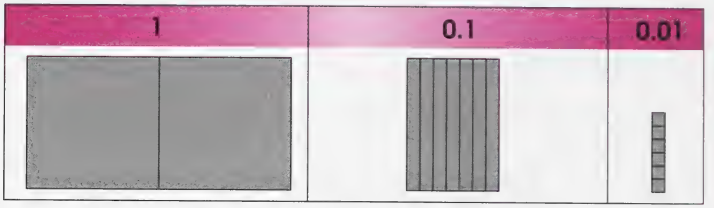
Step 1: Show the factors of the rectangular array.



Step 2: Using these factors as guides, make a rectangle with as few blocks as possible.



Step 3: Rearrange the blocks that formed the rectangle. (Put aside the blocks for the factors).



The result is 2 flats, 7 longs, and 6 small cubes. This represents 2.76.

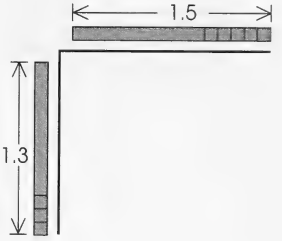
d.

$$\begin{array}{rl} 1.5 & \leftarrow \text{1 decimal place} \\ \times\ 1.3 & \leftarrow \text{1 decimal place} \\ \hline 45 & \\ 15 & \\ \hline 1.95 & \leftarrow \text{2 decimal places} \end{array}$$

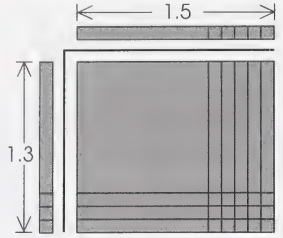
1 decimal place
+ 1 decimal place
2 decimal places

Note: Following is an explanation of how base ten blocks can be used to model the product.

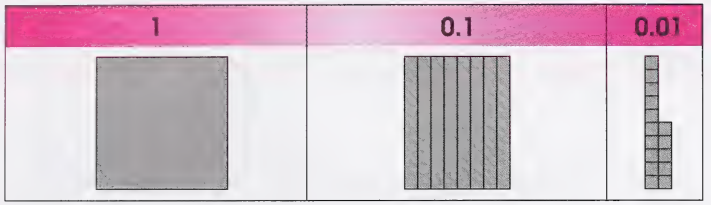
Step 1: Use longs and small cubes to show the factors.



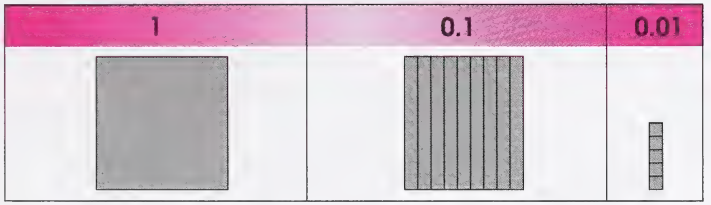
Step 2: Using these factors as guides, build a rectangle with the fewest blocks possible.



Step 3: Rearrange the blocks that formed the rectangle. (Put aside the blocks for the factors.)



Step 4: Trade 10 small cubes for 1 long.



The result is 1 flat, 9 longs, and 5 small cubes. This represents 1.95.

2.
$$\begin{array}{r} 39.98 \\ \times \quad 2 \\ \hline 79.96 \end{array}$$

Louise's purchases cost $79.96.

3.
$$\begin{array}{rl} 2.5 & \leftarrow \text{1 decimal place} \\ \times \ 7.6 & \leftarrow \text{1 decimal place} \\ \hline 150 & \\ 175 & \\ \hline 19.00 & \leftarrow \text{2 decimal places} \end{array}$$

The mass of 1 cm^3 of gold is 19.0 g.

4. a.
$$\begin{array}{rl} 1.2 & \leftarrow \text{1 decimal place} \\ \times \ 0.25 & \leftarrow \text{2 decimal places} \\ \hline 60 & \\ 24 & \\ \hline 0.300 & \leftarrow \text{3 decimal places} \end{array}$$

The buffeo dolphin is 0.3 m wide.

b.
$$\begin{array}{r} 0.25 \\ \times \quad 3 \\ \hline 0.75 \end{array}$$

It is easier to multiply 0.25 by 3.

The bottle-nosed dolphin is 0.75 m wide.

5. a.

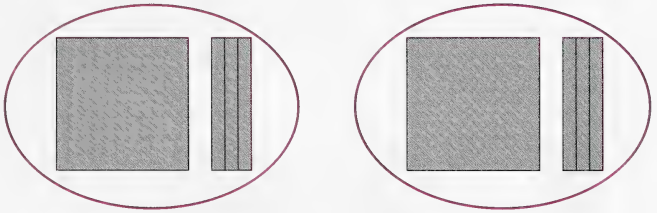
$$\begin{array}{r} 1.3 \\ 2\overline{)2.6} \\ \underline{2} \\ 6 \\ \underline{6} \\ 0 \end{array}$$

Note: Following is an explanation of how you use base ten blocks to model the quotient.

The expression $2.6 \div 2$ means,
"In 2.6 there are 2 groups of **how many**?"

Step 1: Model 2.6.

Step 2: Arrange 2.6 in 2 identical groups.



The result is **1 flat and 3 longs** in each group. This represents 1.3.

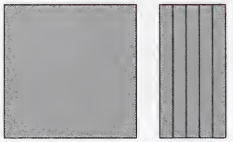
b.

$$\begin{array}{r} 0.5 \\ 3\overline{)1.5} \\ \underline{15} \\ 0 \end{array}$$

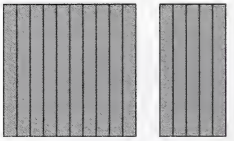
Note: Following is an explanation of how you can use base ten blocks to model the quotient.

The expression $1.5 \div 3$ means,
"In 1.5 there are 3 groups of **how many**?"

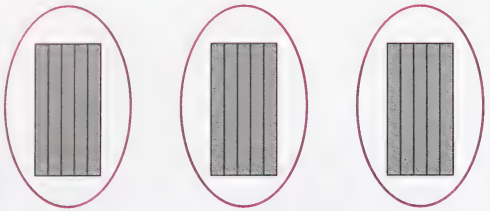
Step 1: Model 1.5.



Step 2: To arrange 1.5 into 3 groups, you must first trade 1 flat for 10 longs.



Step 3: Arrange 1.5 into 3 identical groups.



The result is **5 longs** in each group. This represents 0.5.

6.
$$\begin{array}{r} 0.9 \\ 2\overline{)1.8} \\ \underline{1\ 8} \\ 0 \end{array}$$

Each piece is 0.9 m long.

7.
$$\begin{array}{r} 18.95 \\ 3\overline{)56.85} \\ \underline{3} \\ 26 \\ \underline{24} \\ 2\ 8 \\ \underline{2\ 7} \\ 15 \\ \underline{15} \\ 0 \end{array}$$

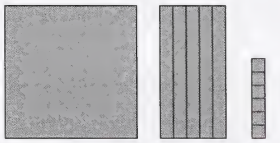
Each CD cost $18.95.

8. a. $1.2\overline{)1.56} \longrightarrow 12\overline{)15.6}$

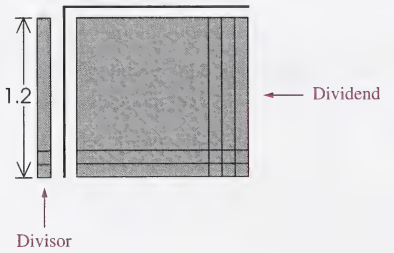
$$\begin{array}{r} 1.3 \\ 12\overline{)15.6} \\ \underline{12} \\ 3\ 6 \\ \underline{3\ 6} \\ 0 \end{array}$$

Note: Following is an explanation of how you can model the quotient. Remember that multiplication and division are related.

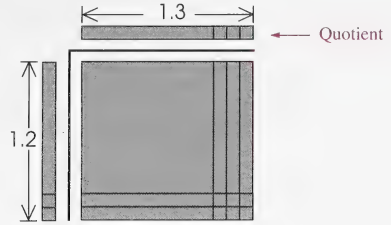
Step 1: Model 1.56.



Step 2: Arrange 1.56 so there are 1.2 rows in a rectangular array.



Step 3: To find the quotient, determine how many columns there are.



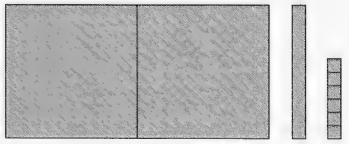
The result is 1.3 columns.

b. $1.2\overline{)2.16}$ ⟶ $12\overline{)21.6}$

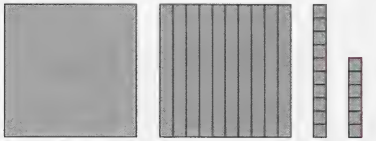
$$\begin{array}{r} 1.8 \\ 12\overline{)21.6} \\ \underline{12} \\ 96 \\ \underline{96} \\ 0 \end{array}$$

Note: Following is an explanation of how you can model the quotient. Remember that multiplication and division are related.

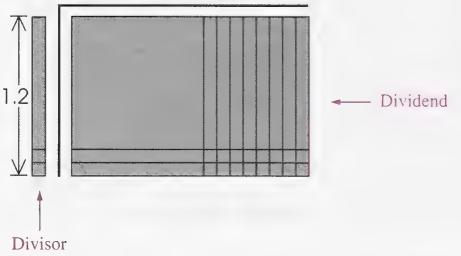
Step 1: Model 2.16.



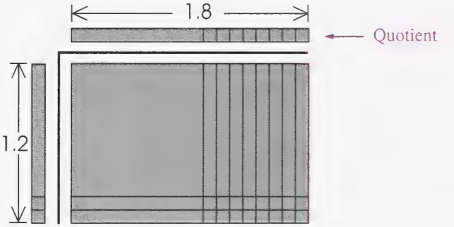
Step 2: In order to arrange 2.16 so that there are 1.2 rows, regrouping is required. Trade 1 flat for 10 longs. Trade 1 long for 10 small cubes.



Step 3: Arrange 2.16 so there are 1.2 rows in a rectangular array.



Step 4: To find the quotient, determine how many columns there are.



The result is 1.8 columns.

9. a. $1.5\overline{)4.80} \longrightarrow 15\overline{)48.0}$

$$\begin{array}{r} 3.2 \\ 15\overline{)48.0} \\ \underline{45} \\ 30 \\ \underline{30} \\ 0 \end{array}$$

The hamburger cost \$3.20 per kilogram.

b. $0.15\overline{)1.5} \longrightarrow 15\overline{)150}$

$$\begin{array}{r} 10 \\ 15\overline{)150} \\ \underline{15} \\ 0 \\ \underline{0} \\ 0 \end{array}$$

Sarika made 10 burgers.

10. $0.02\overline{)14.86} \longrightarrow 2\overline{)1486}$

$$\begin{array}{r} 743 \\ 2\overline{)1486} \\ \underline{14} \\ 8 \\ \underline{8} \\ 6 \\ \underline{6} \\ 0 \end{array}$$

A total of 743 minute beetles laid end to end would equal the length of one goliath beetle.

11. $0.006\overline{)3.06} \longrightarrow 6\overline{)3060}$

$$\begin{array}{r} 510 \\ 6\overline{)3060} \\ \underline{30} \\ 6 \\ \underline{6} \\ 0 \\ \underline{0} \\ 0 \end{array}$$

The book has 510 pages.

12. a. $(+3)\times(-6) = -(3\times 6)$

$= -18$

Note: Following is an explanation of how counters can be used to model the product.

Step 1: Model 3×6.

The expression 3×6 can mean 3 rows of 6.

Step 2: Model $(+3)\times(-6)$. Use this reasoning. Because there is **one** negative factor, exchange the counters in Step 1 **once**.

The result is 18 negative counters. This represents -18.

b. $(-4)\times(-5)=+(4\times5)$

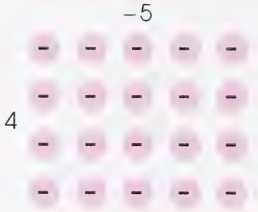
$=+20$

Note: Following is an explanation of how counters can be used to model the product.

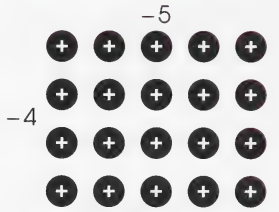
Step 1: Model 4×5.

The expression 4×5 can mean 4 rows of 5.

Step 2: Model $(-4)\times(-5)$. Use this reasoning. Because there are **two** negative factors, exchange the counters in Step 1 for their opposites **twice**.



This is the result of the first exchange.



This is the result of the second exchange.

The result is 20 positive counters. This represents $+20$.

13. a. $(+2)\times(-3)=-(2\times3)$

$=-6$

Megyn was 6 m below her present position.

b. $(+2)\times(+4)=+8$

Megyn will be 8 m above her present position.

14. a. $(-3)\times(+5)=-(3\times5)$

$=-15$

Kai will be 15 m below his present position.

b. $(-3)\times(-2)=+(3\times2)$

$=+6$

Kai was 6 m above his present position.

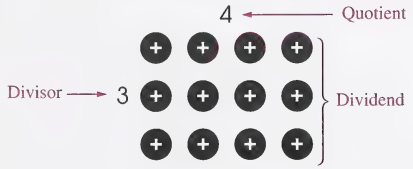
15. a. $(-12)\div(+3)=-(12\div3)$ **Check:** $(+3)\times(-4)=-12$

$=-4$

Note: Following is an explanation of how counters can be used to illustrate the quotient.

Step 1: Model $12\div3$. Remember that the quotient in the statement $12\div3=$ ☐ is the same as the missing factor in the statement $3\times$ ☐ $=12$.

Ask yourself, "12 positive counters can be arranged in 3 rows of **how many**?"



The answer is that 12 positive counters can be arranged in 3 rows of **4**.

Step 2: Model $(-12)\div(+3)$. Remember that the quotient in the statement $(-12)\div(+3)=$ ☐ is the same as the missing factor in the statement $(+3)\times$ ☐ $=-12$.

The dividend is -12 and the divisor is $+3$. Decide whether the quotient is $+4$ or -4. **Hint:** The 12 positive counters in Step 1 must have been exchanged for their opposites **once**.

The quotient is -4.

b. $(+18)\div(-6)=-(18\div6)$

$=-3$

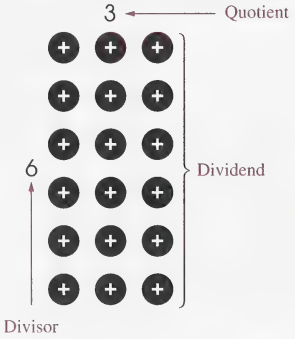
Check

$(-6)\times(-3)=+18$

Note: Following is an explanation of how counters can be used to illustrate the quotient.

Step 1: Model $18 \div 6$. Remember that the quotient in the statement $18 \div 6 = \square$ is the same as the missing factor in the statement $6 \times \square = 18$.

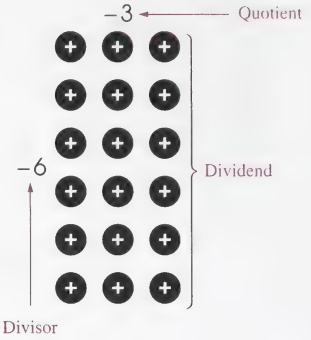
Ask yourself, "18 positive counters can be arranged in 6 rows of **how many**?"



The answer is that 18 positive counters can be arranged in 6 rows of **3**.

Step 2: Model $(+18) \div (-6)$. Remember that the quotient in the statement $(+18) \div (-6) = \square$ is the same as the missing factor in the statement $(-6) \times \square = +18$.

The dividend is $+18$ and the divisor is -6. Decide whether the quotient is $+3$ or -3. **Hint:** The 18 positive counters in Step 1 must have been exchanged for their opposites **twice**.



The quotient is -3.

16. $(-10) \div (+2) = -(10 \div 2)$ **Check:** $(+2) \times (-5) = -10$

$= -5$

The temperature dropped an average of 5°C per hour.

17. $(-1800) \div (-30) = +(1800 \div 30)$

$= +60$

Check: $(-30) \times (+60) = -1800$

It will take 60 min or 1 h.

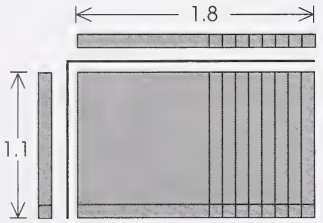
18. a. $(+1.1)\times(-1.8) = -(1.1\times 1.8)$

$= -1.98$

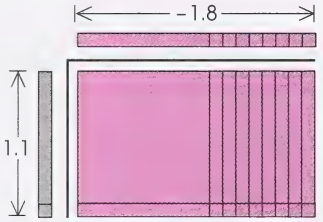
$$\begin{array}{r} 1.8 \\ \times\ 1.1 \\ \hline 18 \\ 18 \\ \hline 1.98 \end{array}$$

Note: Following is an explanation of how you can use base ten blocks to illustrate the product.

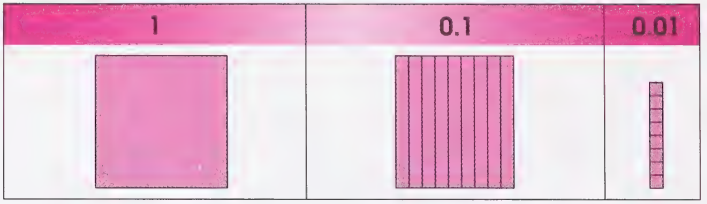
Step 1: Model 1.1×1.8.



Step 2: Model $(+1.1)\times(-1.8)$. Use this reasoning.
Because there is **one** negative factor, exchange the blocks in Step 1 for their opposites **once**.



Step 3: Rearrange the blocks that formed the rectangle. (Put aside the blocks for the factors.)



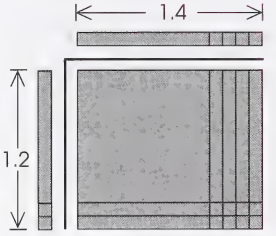
The result is 1 flat, 9 longs, and 8 small cubes. All the blocks are negative. This represents -1.98.

b. $(-1.2)\times(-1.4) = +(1.2\times 1.4)$

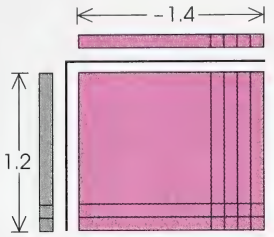
$= +1.68$

$$\begin{array}{r} 1.4 \\ \times\ 1.2 \\ \hline 28 \\ 14 \\ \hline 1.68 \end{array}$$

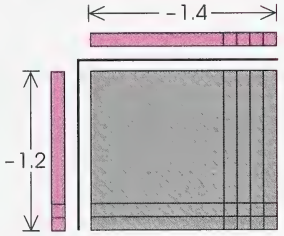
Step 1: Model 1.2×1.4.



Step 2: Model $(-1.2)\times(-1.4)$. Use this reasoning.
Because there are **two** negative factors, exchange the blocks in Step 1 for their opposites **twice**.

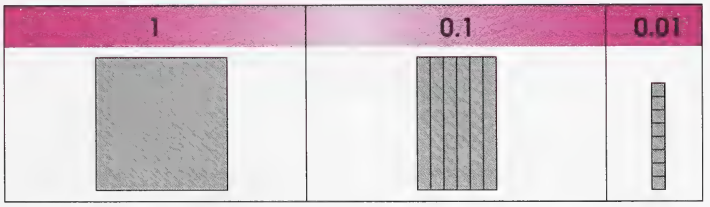


This is the result of the first exchange.



This is the result of the second exchange.

Step 3: Rearrange the blocks that formed the rectangle.
(Put aside the blocks for the factors.)



The result is 1 flat, 6 longs, and 8 small cubes. All the blocks are positive. This represents $+1.68$.

19. $(+7)\times(-14.2)=-(7\times14.2)$
$=-99.4$

Altogether, the ship is lowered 99.4 m.

20. a. $(-1.56)\div(+1.2)=-(1.56\div1.2)$
$=-1.3$

$1.2\overline{)1.56}$ → $12\overline{)15.6}$

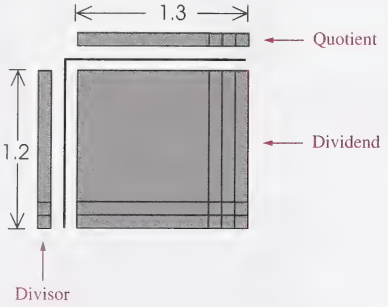
$$\begin{array}{r} 1.3 \\ 12\overline{)15.6} \\ \underline{12} \\ 36 \\ \underline{36} \\ 0 \end{array}$$

Check: $+1.2\times(-1.3)=-1.56$

$$\begin{array}{r} 1.3 \\ \times\ 1.2 \\ \hline 26 \\ 13 \\ \hline 1.56 \end{array}$$

Step 1: Model $1.56 \div 1.2$. Remember that the quotient in $1.56 \div 1.2 =$ ▢ is the same as the missing factor in $1.2 \times$ ▢ $= 1.56$.

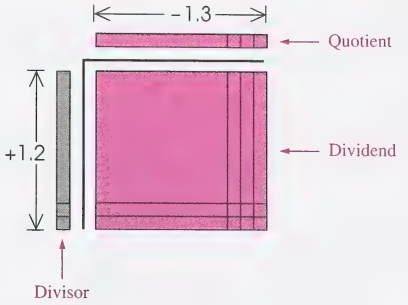
Ask yourself, "1.56 can be arranged in a rectangle with 1.2 rows and **how many** columns?"



The answer is that 1.56 can be arranged in a rectangle with 1.2 rows and 1.3 columns.

Step 2: Model $(-1.56) \div (+1.2)$. Remember that the quotient in $(-1.56) \div (+1.2) =$ ▢ is the same as the missing factor in $(+1.2) \times$ ▢ $= -1.56$.

The dividend is -1.56 and the divisor is $+1.2$. Decide whether the quotient is $+1.3$ or -1.3.
Hint: The model for $+1.56$ in Step 1 must have been exchanged for its opposite **once**.



The quotient is -1.3.

b. $(+1.65)\div(-1.5)=-(1.65\div 1.5)$

$=-1.1$

$1.5\overline{)1.65} \longrightarrow 15\overline{)16.5}$

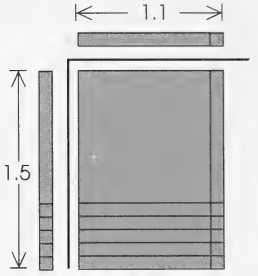
$$\begin{array}{r} 1.1 \\ 15\overline{)16.5} \\ \underline{15} \\ 15 \\ \underline{15} \\ 0 \end{array}$$

Check: $(-1.5)\times(-1.1)=+1.65$

$$\begin{array}{r} 1.1 \\ \times\ 1.5 \\ \hline 55 \\ \underline{11} \\ 1.65 \end{array}$$

Step 1: Model $1.65\div 1.5$. Remember that the quotient in $1.65\div 1.5=$ ▢ is the same as the missing factor in $1.5\times$ ▢ $=1.65$.

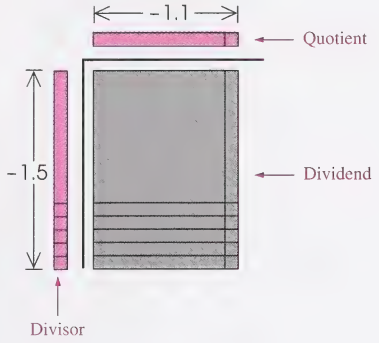
Ask yourself, "1.65 can be arranged in a rectangle with 1.5 rows and **how many** columns?"



The answer is 1.65 can be arranged in a rectangle with 1.5 rows and 1.1 columns.

Step 2: Model $(+1.65)\div(-1.5)$. Remember that the quotient in $(+1.65)\div(-1.5)=$ ▢ is the same as the missing factor in $(-1.5)\times$ ▢ $=+1.65$.

The dividend is $+1.65$ and the divisor is -1.5. Decide whether the quotient is $+1.1$ or -1.1. **Hint:** The model for $+1.65$ in Step 1 must have been exchanged for its opposite **twice**.



The quotient is -1.1.

21. $(-1.50)\div 5=-(1.50\div 5)$ **Check:** $5\times(-0.30)=-1.50$
$=-0.30$

On average the stock dropped \$0.30 each day.

22. What has twelve humps and lives at the North Pole?—SIX LOST CAMELS.

23. A sign in an antique store says REMAINS TO BE SEEN.
A sign on a waterbed says SEA FOR YOURSELF.
A sign on a laundry truck says WE LIKE CLOTHES CALLS.

Did You Know?

24. a. $(-24)\div(-10)=+(24\div 10)$
$=+2.4$

The windchill equivalent temperature is 2.4 times colder.

b. $2\times(-18.5)=-(2\times 18.5)$
$=-37$

The windchill equivalent temperature is $-37°\text{C}$.

25. Use logic to solve this problem.

There are 6 sisters.
There are 2 brothers.
There is a mother and a father.

$$\begin{array}{r} 6 \\ 2 \\ +\ 2 \\ \hline 10 \end{array}$$

There are 10 people in the family.

Note: If you thought there were 12 brothers, reread the problem. The two brothers are brothers to each sister.

26. Make an organized list.

Nickels	Dimes	Quarters	Loonies
0	0	0	1
0	0	4	0
1	2	3	0
3	1	3	0
5	0	3	0
0	5	2	0
2	4	2	0
4	3	2	0
6	2	2	0
8	1	2	0
10	0	2	0
1	7	1	0
3	6	1	0
5	5	1	0
7	4	1	0
9	3	1	0
11	2	1	0
13	1	1	0
15	0	1	0
0	10	0	0
2	9	0	0
4	8	0	0
6	7	0	0
8	6	0	0
10	5	0	0
12	4	0	0
14	3	0	0
16	2	0	0
18	1	0	0
20	0	0	0

There are 30 ways Allistair could deposit $1.

Section 2: Follow-up Activities

Extra Help

1. a. The product (or quotient) of two numbers with like signs is positive.

b. The product (or quotient) of two numbers with unlike signs is negative.

2. a. $(-1.2)\times(+1.8)=-(1.2\times1.8)$

$=-2.16$

$$\begin{array}{r} 1.2 \\ \times\ 1.8 \\ \hline 96 \\ 12 \\ \hline 2.16 \end{array}$$

b. $(-1.4)\times(-1.8)=+(1.4\times1.8)$

$=+2.52$

$$\begin{array}{r} 1.4 \\ \times\ 1.8 \\ \hline 112 \\ 14 \\ \hline 2.52 \end{array}$$

c. $(+1.6)\times(-1.4)=-(1.6\times1.4)$

$=-2.24$

$$\begin{array}{r} 1.6 \\ \times\ 1.4 \\ \hline 64 \\ 16 \\ \hline 2.24 \end{array}$$

d. $(-1.2)\times(-1.5)=+(1.2\times1.5)$

$=+1.8$

$$\begin{array}{r} 1.2 \\ \times\ 1.5 \\ \hline 60 \\ 12 \\ \hline 1.80 \end{array}$$

e. $(-47.7)\div(+0.09)=-(47.7\div0.09)$

$=-530$

$0.09\overline{)47.7} \longrightarrow 9\overline{)4770}$

$$\begin{array}{r} 530 \\ 9\overline{)4770} \\ 45 \\ \hline 27 \\ 27 \\ \hline 00 \\ 0 \\ \hline 0 \end{array}$$

f. $(+36.9)\div(-4.1)=-(36.9\div4.1)$

$=-9$

$4.1\overline{)36.9} \longrightarrow 41\overline{)369}$

$$\begin{array}{r} 9 \\ 41\overline{)369} \\ 369 \\ \hline 0 \end{array}$$

Enrichment

1. Answers will vary. An example for each set of cards is given here.

a. $(-3)\times(+5)-(-5)$

$=(-15)-(-5)$

$=(-15)+(+5)$

$=-(15-5)$

$=-10$

b. $(+7)\times(-4)\div(+3)$

$=(-28)\div(+3)$

$=-(28\div3)$

$=-9.\dot{3}$

The dot above the 3 indicates that the 3 repeats.

2. For a greater challenge, try playing "Target" with a deck of ordinary playing cards. Let the black suits (spades and clubs) be positive. Let the red suits (hearts and diamonds) be negative.

The World's First Radio Broadcast

Achievement: The world's first radio broadcast.

Date: 1906

Inventor: Reginald Fessenden, born in 1866 in Milton-Est, Que., died in Bermuda in 1932.

Significance: Fessenden's demonstration of long-distance radio transmission was an early milestone in the development of broadcasting.

Profile: The son of a poor and peripatetic clergyman, Reginald Fessenden began his own wanderings after studying at Bishop's University in Lennoxville, Que. He got a teaching job in Bermuda, but then moved to the United States, to become a chemist in Thomas Edison's celebrated research laboratory. He quit this job to work, briefly, for Edison's arch rival George Westinghouse, before becoming a professor of electrical engineering, first at Purdue, then Pittsburgh. At the turn of the century, Fessenden left college teaching to devote his inventive mind to the infant technology of radio. His many inventions include the superheterodyne, the technological foundation stone for modern radio, the aluminum foil tea bag ("Fresh from Oven to Cup"), and an altimeter for aircraft.

Wireless sounds: In 1900 Fessenden began experimenting with wireless telegraphy for the U.S. Weather Bureau. Radio waves, conventional wisdom had it, were limited to carrying signals encoded as a simple on-or-off pulses of electrical energy, to serving as a telegraph without wires. Like Alexander Graham Bell, his childhood hero, Fessenden was captivated by sound, and he was convinced that radio waves were not limited, that they could carry the richly and continuously varying signals that make up speech and music; that, in short, radio telephony was possible. "Fezzie," Edison had said when Fessenden explained his dream, "what do you say are man's chances of jumping over the moon? I figure that one is about as likely as the other."

But late in 1900 Fessenden transmitted the spoken message, "Is it snowing where you are, Mr. Thiessen?" to his assistant, stationed a short distance away. He did not hesitate to let Edison, Marconi and the other experts know that he had proved them wrong.

Next, Fessenden organized the National Electric Signalling Company. After several years of research, he perfected a high frequency alternator, an essential part of his transmitter, and then built two towers to house radio stations, one off the coast of Massachusetts, the other on the coast of Scotland. In December 1901, Marconi had transmitted the first transatlantic wireless communication in Morse code, but in 1906 Fessenden achieved two-way voice communication across the Atlantic between these towers. Then, on Christmas Eve, 1906, he made the first radio broadcast. Wireless operators on board ships of the United Fruit Company (Fessenden's client) within 500 km of Boston, were his amazed audience. Instead of the dots and dashes of signals in Morse code, they heard speech and music over the hiss of their receivers. Fessenden said a few words, played a phonograph recording and then himself played on the violin.

The First Commercial Radio Receiver Powered by Alternating Current

Innovation: The first commercial radio receiver powered by alternating current.

Date: 1925

Innovator: Edward Samuel Rogers, amateur engineer and entrepreneur, born in Toronto in 1900, and died there in 1939.

Significance: The Rogers' "Batteryless" Radio—"just plug in, then tune in"—launched the age of electronic entertainment in Canada.

Profile: Ted Rogers began toying with radio when he was a boy, and when the technology was in its infancy. By tuning in a short-wave broadcast from London in August 1914, he learned that England had declared war on Germany hours before the Toronto papers carried the story.

Rogers was a poor student—he left the University of Toronto's school of practical science after a short spell—but, though shy, he was an enthusiastic and energetic experimenter. When his Morse code signals were received in Scotland in 1921 he became the first Canadian amateur to send a message across the Atlantic by radio.

The following year his father, who wanted him to become a business executive, bought him the Independent Telephone Company, which manufactured the radios of the day: crystal sets, used with headphones, and cumbersome battery-powered sets. Rogers predicted a lucrative market for a radio powered by alternating current from the main circuit, rather than by direct current from a battery. The key to this, he realized, was a radio tube that worked on alternating current. When he learned that F.S. McCullogh of Pittsburgh had invented such a tube, he boldly bought Canadian rights to exploit the crude and untried device and, helped by two engineers, spent a frenzied year developing a marketable radio based on it.

In 1925 Rogers filed, successfully, for a Canadian patent on his innovation, and later that year exhibited the first of his new "batteryless" radios at the Canadian National Exhibition. The five-tube Rogers "Majestic" sold for $260, plus an additional $45 for the speaker. Despite its high cost it was a commercial success, for relative to battery-powered radios it was superior in both convenience—it was simply plugged into a light socket—and in sound quality. Other batteryless receivers had come on the market, but Rogers' was one of the best.

To enlarge the market for his radios Rogers founded a radio station. CFRB—the last two of its call letters stand for "Rogers Batteryless"—first broadcast in 1927. Its transmissions were clearer and more powerful than those of the five other radio stations that existed, rather tenuously, in Toronto, and its shows were far bigger and better.

By the 1930s, Rogers was pioneering the next phase of electronic entertainment. He was awarded one of the first licences to transmit television in Canada.

Which Insects Most Often Fall in Love?

Do each exercise and find your answer at the bottom of the page. Cross out the letter above each correct answer. When you finish, the answer to the title question will remain.

1 $3\frac{1}{2} + 4\frac{3}{10}$

2 $7\frac{7}{9} + 1\frac{1}{3}$

3 $4\frac{3}{4} + 9\frac{2}{5}$

4 $2\frac{7}{8} + 5\frac{1}{2}$

5 $1\frac{5}{6} + 6\frac{2}{3}$

6 $10\frac{1}{4} + 7\frac{5}{12}$

7 $3\frac{7}{9} + 8\frac{5}{6}$

8 $34\frac{3}{5} + 29\frac{1}{3}$

9 $71\frac{6}{7} + 6\frac{1}{2}$

10 $18\frac{2}{3} + 18\frac{7}{12}$

11 $8\frac{3}{8} + 5\frac{1}{5}$

12 $50\frac{1}{6} + 11\frac{9}{10}$

13 $3\frac{1}{4} + 5\frac{2}{3}$

14 $23\frac{7}{8} + 1\frac{3}{16}$

B	R	E	U	O	G	L	M	P	S	E	A	G	N	H	A	I	T	O	N	S	E
$62\frac{1}{15}$	$13\frac{7}{20}$	$9\frac{1}{9}$	$78\frac{5}{14}$	$8\frac{3}{4}$	$12\frac{11}{18}$	$25\frac{1}{16}$	$25\frac{1}{4}$	$8\frac{3}{8}$	$37\frac{1}{4}$	$12\frac{11}{14}$	$78\frac{11}{14}$	$7\frac{4}{5}$	$62\frac{4}{15}$	$63\frac{14}{15}$	$8\frac{11}{12}$	$8\frac{1}{2}$	$37\frac{5}{8}$	$13\frac{23}{40}$	$14\frac{3}{20}$	$17\frac{1}{4}$	$17\frac{2}{3}$

Where Do Trees Go When One Tree Has a Birthday?

Cross out the box containing each correct answer. When you finish, write the letters from the remaining boxes in the spaces at the bottom of the page.

1 $8\frac{1}{4} - 5\frac{1}{2}$

2 $9\frac{1}{3} - 4\frac{5}{6}$

3 $6\frac{3}{10} - 2\frac{1}{2}$

4 $7\frac{1}{5} - 3\frac{3}{4}$

5 $12\frac{4}{9} - 1\frac{2}{3}$

6 $30\frac{1}{4} - 8\frac{7}{12}$

7 $18\frac{1}{3} - 3\frac{4}{5}$

8 $9\frac{2}{9} - 8\frac{1}{2}$

9 $5\frac{1}{4} - \frac{7}{10}$

10 $27\frac{2}{3} - 6\frac{7}{8}$

11 $44\frac{11}{15} - 38\frac{2}{5}$

12 $15\frac{1}{6} - \frac{3}{10}$

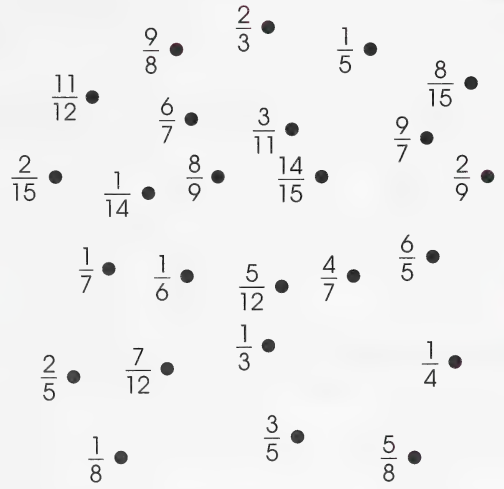
13 $97\frac{1}{4} - 74\frac{9}{16}$

14 $11\frac{1}{2} - 8\frac{5}{8}$

TH	IN	TO	ES	TR	IT	EE	SL	OW	DR	UM
$3\frac{9}{20}$	$22\frac{11}{16}$	$20\frac{11}{24}$	$2\frac{3}{4}$	$20\frac{19}{24}$	$22\frac{3}{16}$	$\frac{13}{18}$	$10\frac{5}{9}$	$2\frac{7}{8}$	$4\frac{1}{2}$	$2\frac{1}{4}$
TO	BE	AM	UP	RP	ST	AR	KS	CA	TY	KE
$14\frac{13}{15}$	$6\frac{3}{5}$	$14\frac{8}{15}$	$3\frac{4}{5}$	$\frac{7}{18}$	$10\frac{7}{9}$	$14\frac{4}{15}$	$6\frac{1}{3}$	$21\frac{2}{3}$	$4\frac{7}{20}$	$4\frac{11}{20}$

Superstar

Work the problems to the right and find the correct answers below. Connect the dots in the same order as the problems are numbered. After every four dots, lift your pencil and begin again with the next dot (do NOT connect dot 4 to the next dot 1). You may go through the same dot more than once.



1. $\frac{2}{3} \times \frac{6}{7} =$
2. $\frac{3}{8} \times \frac{5}{3} =$
3. $\frac{2}{5} \times \frac{5}{6} =$
4. $\frac{11}{12} \times \frac{8}{11} =$

Lift Pencil

1. $\frac{1}{22} \times \frac{11}{4} =$
2. $\frac{7}{4} \times \frac{8}{15} =$
3. $\frac{8}{9} \times \frac{3}{4} =$
4. $\frac{10}{9} \times \frac{12}{15} =$

Lift Pencil

1. $\frac{3}{7} \times \frac{7}{9} =$
2. $\frac{3}{10} \times \frac{5}{12} =$
3. $\frac{9}{8} \times \frac{4}{27} =$
4. $\frac{5}{9} \times \frac{6}{15} =$

Lift Pencil

1. $\frac{3}{2} \times \frac{5}{12} =$
2. $\frac{8}{3} \times \frac{6}{18} =$
3. $\frac{1}{9} \times \frac{6}{5} =$
4. $\frac{3}{8} \times \frac{4}{9} =$

Lift Pencil

1. $\frac{21}{25} \times \frac{10}{9} =$
2. $\frac{7}{12} \times \frac{8}{21} =$
3. $\frac{2}{5} \times \frac{10}{7} =$
4. $\frac{9}{20} \times \frac{8}{27} =$

Hidden Message

To find the hidden message, follow these directions:

First, work each problem, put your answer in simplest form, and find your answer in the rectangle below. The correct answer will be found in 2 or 3 consecutive boxes, running across from left to right.

Second, cross out each correct answer. When you finish, there will be 22 boxes not crossed out.

Starting on the top line and working from left to right, print the 22 letters that remain into the boxes at the bottom of the page. The hidden message will appear!

1 $1\frac{1}{2}\times 2\frac{1}{6}=$ 2 $2\frac{5}{8}\times 1\frac{2}{7}=$ 3 $3\frac{5}{6}\times 1\frac{1}{3}=$ 4 $4\frac{1}{5}\times 2\frac{2}{3}=$ 5 $4\frac{4}{5}\times 1\frac{1}{6}=$ 6 $1\frac{1}{8}\times 6\frac{6}{7}=$

7 $3\frac{3}{10}\times 1\frac{1}{11}=$ 8 $2\frac{2}{3}\times 5\frac{1}{4}=$ 9 $6\frac{3}{5}\times 2\frac{7}{9}=$ 10 $1\frac{3}{8}\times 7\frac{2}{11}=$ 11 $8\frac{3}{4}\times 6\frac{2}{5}=$ 12 $2\frac{7}{10}\times 2\frac{1}{12}=$

R	E	M	U	S	T	L	T	O	E	I	R	V	U	P	L
3	$\frac{1}{4}$	8	$\frac{6}{7}$	7	$\frac{5}{7}$	1	$\frac{2}{9}$	5	6	7	1	1	$\frac{1}{5}$	6	$\frac{9}{10}$
I	P	G	C	A	I	A	T	I	C	E	O	N	M	H	I
3	1	4	9	3	$\frac{3}{8}$	2	4	$\frac{2}{5}$	3	$\frac{3}{5}$	6	$\frac{7}{8}$	5	$\frac{5}{8}$	9
S	R	E	L	A	T	E	N	F	D	Y	O	X	A	I	K
8	$\frac{1}{6}$	5	$\frac{3}{5}$	3	6	$\frac{5}{12}$	9	$\frac{7}{8}$	4	5	$\frac{1}{9}$	9	1	8	$\frac{1}{3}$

How's Business?

TAILOR: "Mine is _____."

$\frac{9}{4}$ $\frac{13}{3}$ $\frac{1}{2}$ $\frac{9}{14}$ $\frac{3}{25}$ $\frac{20}{3}$ $\frac{1}{30}$ $\frac{3}{25}$ $\frac{20}{3}$ $\frac{1}{30}$

GARBAGE COLLECTOR: "Mine is _____."

$\frac{3}{4}$ $\frac{11}{6}$ $\frac{21}{2}$ $\frac{6}{5}$ $\frac{11}{6}$ $\frac{13}{3}$ $\frac{10}{3}$ $\frac{16}{5}$ $\frac{3}{4}$

AUTHOR: "Mine is _____."

$\frac{2}{3}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{30}$ $\frac{3}{5}$ $\frac{11}{6}$ $\frac{9}{5}$ $\frac{20}{3}$

REFRIGERATOR SALESPERSON: "Mine is _____."

$\frac{13}{3}$ $\frac{9}{4}$ $\frac{9}{5}$ $\frac{3}{25}$ $\frac{9}{4}$ $\frac{3}{7}$ $\frac{9}{4}$ $\frac{9}{5}$

Each of these people answered the question, "How's business?" To decode their answers, follow these directions:

First, work any problem below and find your answer in the code. Each time the answer appears in the code, write the letter of that problem above it. (The same code is used for all four people.)

Keep working until you have decoded the four hilarious answers.

P $= \frac{1}{4} \div \frac{1}{3} =$

U $= \frac{6}{5} \div \frac{3}{8} =$

A $= \frac{3}{5} \div \frac{9}{10} =$

R $= \frac{2}{5} \div \frac{2}{3} =$

L $= \frac{7}{8} \div \frac{7}{4} =$

I $= \frac{11}{3} \div 2 =$

Y $= \frac{2}{7} \div \frac{4}{9} =$

G $= 3 \div \frac{9}{10} =$

W $= \frac{4}{15} \div 8 =$

H $= \frac{3}{8} \div \frac{7}{8} =$

N $= 4 \div \frac{12}{13} =$

T $= \frac{12}{25} \div \frac{4}{15} =$

K $= \frac{4}{5} \div \frac{2}{3} =$

C $= 9 \div \frac{6}{7} =$

S $= \frac{9}{5} \div 15 =$

E $= 5 \div \frac{3}{4} =$

O $= \frac{6}{7} \div \frac{8}{21} =$

Bingo

Work any problem below and find your answer in the bingo box. Circle the answer.

Keep working the problems IN ANY ORDER until you have five circled answers in a line—horizontally, vertically, or diagonally.

1 $3\frac{1}{3} \div 1\frac{3}{7} =$

2 $4\frac{1}{2} \div 2\frac{2}{5} =$

3 $6\frac{2}{3} \div 1\frac{1}{9} =$

4 $1\frac{7}{8} \div 3\frac{1}{3} =$

5 $4\frac{1}{6} \div 3\frac{3}{4} =$

6 $8 \div 3\frac{1}{5} =$

7 $3\frac{1}{4} \div 13 =$

8 $8\frac{2}{3} \div 2\frac{3}{5} =$

9 $6 \div 6\frac{3}{4} =$

10 $2\frac{3}{8} \div 1\frac{1}{2} =$

11 $5\frac{5}{6} \div 1\frac{5}{9} =$

12 $3\frac{1}{3} \div 15 =$

13 $2\frac{5}{8} \div 2\frac{4}{5} =$

14 $7\frac{1}{2} \div 4\frac{1}{6} =$

15 $3\frac{1}{7} \div 8\frac{1}{4} =$

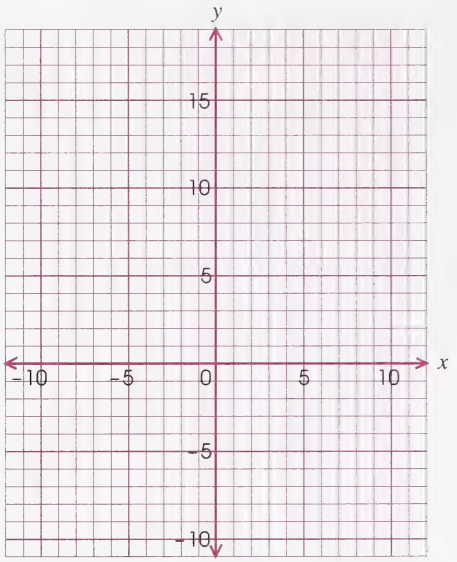
16 $4\frac{9}{10} \div 2\frac{11}{12} =$

$3\frac{3}{4}$	$3\frac{7}{8}$	$\frac{8}{21}$	3	$\frac{2}{9}$
$2\frac{3}{25}$	6	$1\frac{5}{6}$	$1\frac{1}{9}$	$1\frac{17}{25}$
$3\frac{1}{3}$	$2\frac{5}{9}$	$\frac{9}{16}$	$2\frac{1}{3}$	$2\frac{1}{2}$
$\frac{15}{16}$	$1\frac{4}{5}$	7	$1\frac{7}{8}$	$\frac{2}{3}$
$\frac{8}{9}$	$\frac{1}{4}$	$4\frac{1}{8}$	$1\frac{7}{12}$	$1\frac{3}{4}$

Puzzle 1

Connect the points in order. Do not connect points separated by "Lift Pencil." Shade in areas formed by points inside a box.

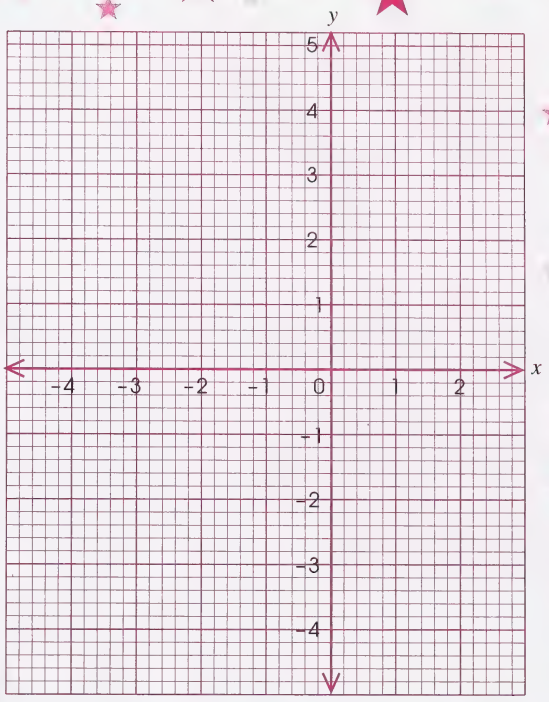
$(-2,-10)$	$(7,16)$	$(-10,17)$	Lift Pencil	$(1,-6)$	$(11,1)$
$(-1,-9)$	$(10,17)$	$(-6,12)$	$(3,2)$	$(0,-5)$	Lift Pencil
$(-7,-7)$	$(10,16)$	$(-5,7)$	$(1,4)$	$(-2,-5)$	$(4,-2)$
$(-9,-5)$	$(8,12)$	Lift Pencil	$(1,0)$	$(-3,-4)$	$(11,-2)$
$(-10,-5)$	$(1,5)$	$(1,7)$	$(3,0)$	$(-1,-3)$	Lift Pencil
$(-9,-4)$	$(2,4)$	$(2,11)$	$(3,1)$	$(0,-3)$	$(0,-2)$
$(-10,-4)$	$(4,0)$	$(4,13)$	$(2,0)$	$(1,-6)$	$(-7,-1)$
$(-8,-2)$	$(6,0)$	$(9,16)$	$(2,2)$	Lift Pencil	Lift Pencil
$(-10,-2)$	$(8,-1)$	$(6,12)$	$(3,2)$	$(2,-6)$	$(0,-2)$
$(-7,0)$	$(7,-1)$	$(1,7)$	$(3,1)$	$(1,-7)$	$(-8,-4)$
$(-5,4)$	$(8,-3)$	Lift Pencil	Lift Pencil	$(0,-7)$	
$(-6,6)$	$(7,-2)$	$(0,2)$	$(-7,0)$	$(-2,-5)$	
$(-10,10)$	$(8,-4)$	$(-1,4)$	$(1,-1)$	Lift Pencil	
$(-11,16)$	$(7,-4)$	$(-3,2)$	$(3,-1)$	$(2,-3)$	
$(-11,18)$	$(5,-7)$	$(-2,0)$	$(2,-2)$	$(2,-5)$	
$(-9,18)$	$(2,-9)$	$(-1,0)$	$(1,-1)$	Lift Pencil	
$(-5,13)$	$(3,-10)$	$(0,2)$	Lift Pencil	$(-1,-5)$	
$(-3,6)$	Lift Pencil	$(-1,2)$	$(0,-3)$	$(0,-6)$	
$(-1,6)$	$(-5,7)$	$(-2,1)$	$(4,-3)$	Lift Pencil	
$(2,13)$	$(-9,11)$	$(-1,0)$	$(3,-6)$	$(4,-2)$	



Puzzle 2

Connect the points in order. Do not connect the points separated by "Lift Pencil."

$(-1.4, -1.6)$	$(-2.2, 1.2)$	Lift Pencil
$(-1, -1.3)$	$(-2.8, 2.1)$	$(2.5, 3.1)$
$(-0.6, -1)$	$(-3, 3.6)$	$(2.6, 1.4)$
$(0, 0.8)$	$(-2.2, 5)$	$(2.6, 1)$
$(-0.8, 2)$	Lift Pencil	$(2.4, 0.4)$
$(-2.2, 1.2)$	$(-2.8, 2.1)$	$(2.2, -0.2)$
$(-1.4, -1.6)$	$(-3.4, 3.4)$	$(2, -0.6)$
$(-2, -3.8)$	$(-2.8, 5)$	Lift Pencil
$(0.4, -3.4)$	Lift Pencil	$(-1.4, -1.6)$
$(-0.6, -1)$	$(0, 0.8)$	$(-1, -2.6)$
Lift Pencil	$(2.6, 1)$	Lift Pencil



What Has Twelve Humps and Lives at the North Pole?

Some of these exercises have a number and some have a letter. Find two exercises, one with a number and one with a letter, that have the **same answer**. The number tells you where to put the letter in the row of boxes at the bottom of the page.

Keep working and you will discover the answer to the title question.

1 $(+0.3)\times(-0.4)=$

2 $(-6)\times(-0.002)=$

3 $(+0.01)\times(+120)=$

4 $(-0.04)\times(+0.03)=$

5 $(-0.04)\times(+6)=$

6 $(-24)\times(-0.01)=$

7 $(+8)\times(-0.003)=$

8 $(+0.002)\times(+12)=$

9 $(-0.06)\times(+400)=$

10 $(+0.4)\times(-5)=$

11 $(+0.005)\times(+0.04)=$

12 $(-200)\times(+0.001)=$

13 $(-10)\times(-0.02)=$

I $(-0.04)\times(-0.3)=$

S $(-0.1)\times(-2)=$

E $(+0.05)\times(+0.004)=$

O $(-0.8)\times(+0.3)=$

S $(-0.6)\times(+0.2)=$

A $(+240)\times(-0.1)=$

X $(-60)\times(-0.02)=$

L $(+0.4)\times(-0.5)=$

M $(+20)\times(-0.1)=$

T $(+0.1)\times(-0.24)=$

C $(-0.6)\times(-0.04)=$

S $(+0.2)\times(+1.2)=$

L $(+0.1)\times(-0.012)=$

1	2	3	4	5	6	7	8	9	10	11	12	13

Sign Up

Sign in an antique store:

−4390	800	−0.0079	−379	−0.2	0.04	−70.9	−3.7	68.037	−275	800	−70.9	800	800	0.04

Sign on a waterbed:

−70.9	800	−379	−0.879	68.037	−4390	−5.008	68.037	4.39	−4390	−70.9	800	7.09	−0.879

Sign on a laundry truck:

0.083	800	7.09	−0.2	6.556	800	68	7.09	68.037	−3.7	2789.06	800	−70.9	68	−379	7.09	7.09	−70.9

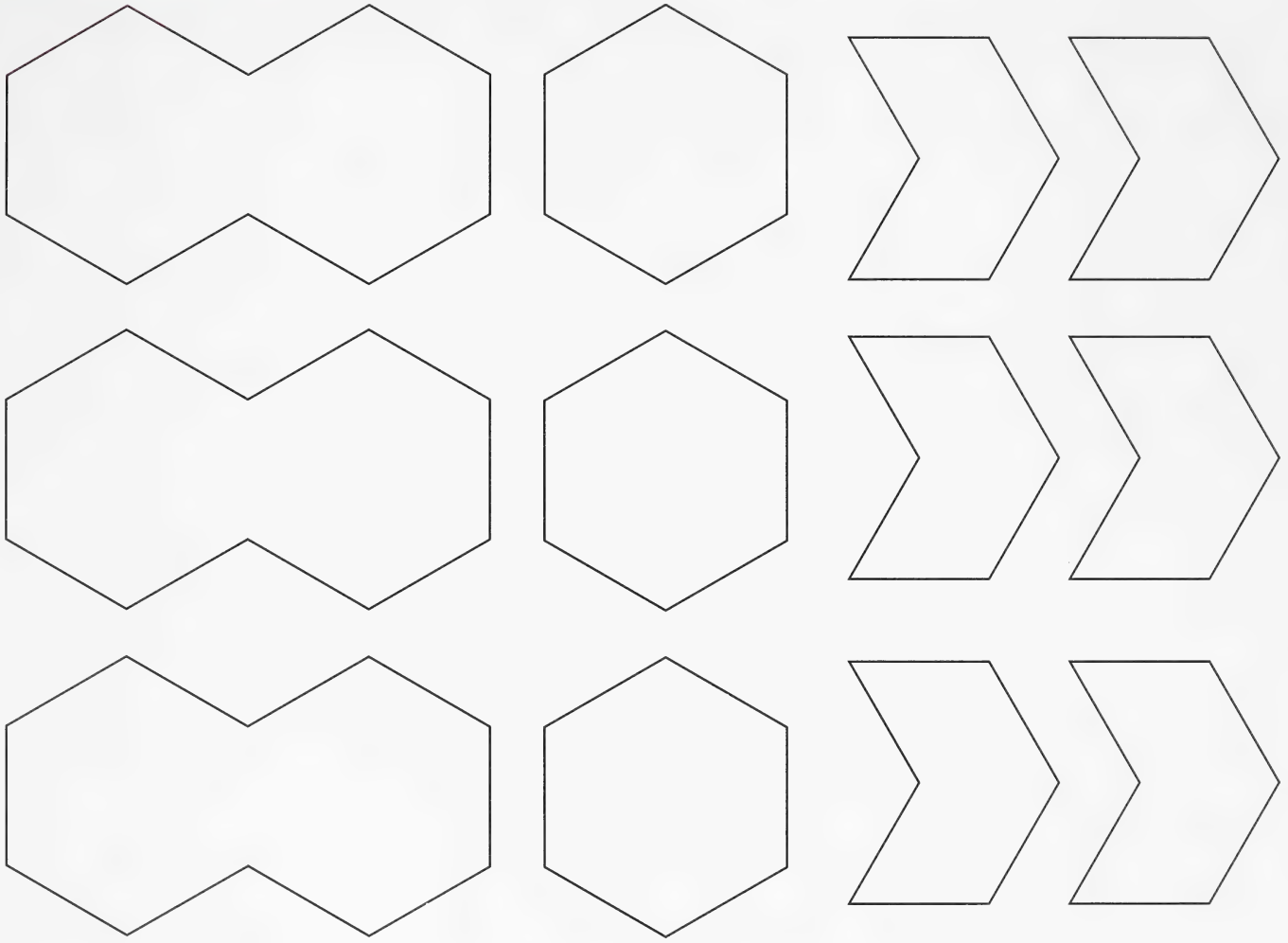
To decode these three signs, do any exercise and find the answer in the code. Each time the answer appears in the code, write the letter of that exercise above it. Keep working and you will decode all three signs. Enjoy the signery!

I	$(-0.6)\div(+3)=$	U	$(+0.3073)\div(+0.07)=$	R	$(-439)\div(+0.1)=$	M	$(-0.0237)\div(+3)=$
N	$(-0.24)\div(-6)=$	A	$(-2.274)\div(+0.006)=$	B	$(+2.2)\div(-0.008)=$	L	$(-6.381)\div(-0.9)=$
F	$(+4.395)\div(-5)=$	W	$(-0.003\,32)\div(-0.04)=$	O	$(-34.0185)\div(-0.5)=$	S	$(+7090)\div(-100)=$
K	$(-59.004)\div(-9)=$	C	$(-61.2)\div(-0.9)=$	H	$(+5.578\,12)\div(+0.002)=$		
T	$(+2.96)\div(-0.8)=$	Y	$(+0.350\,56)\div(-0.07)=$	E	$(-3.2)\div(-0.004)=$		

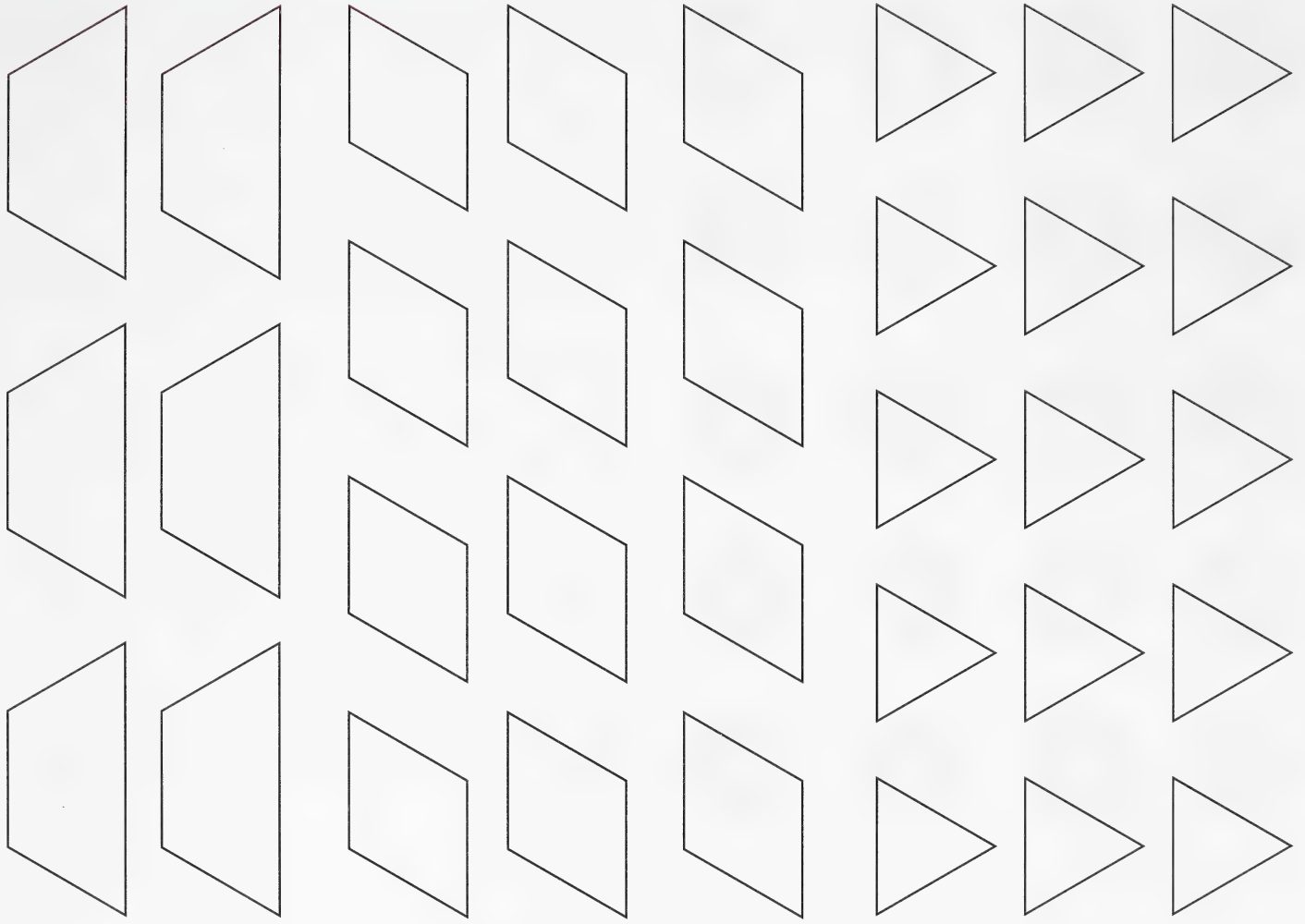
Target Cards

−9	−8	−7	−6	−5
−4	−3	−2	−1	0
+1	+2	+3	+4	+5
+6	+7	+8	+9	

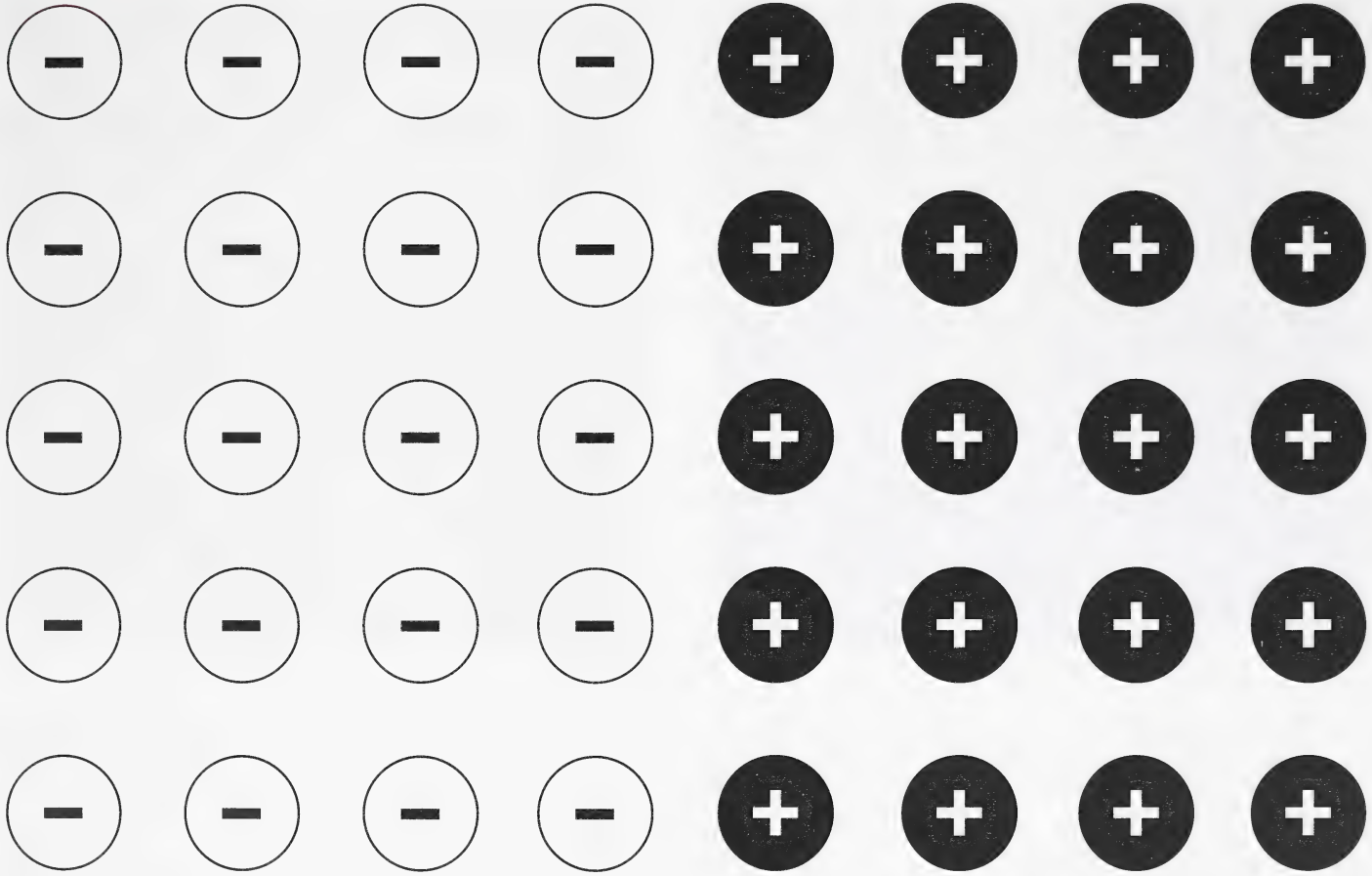
Pattern Blocks



Pattern Blocks (Continued)

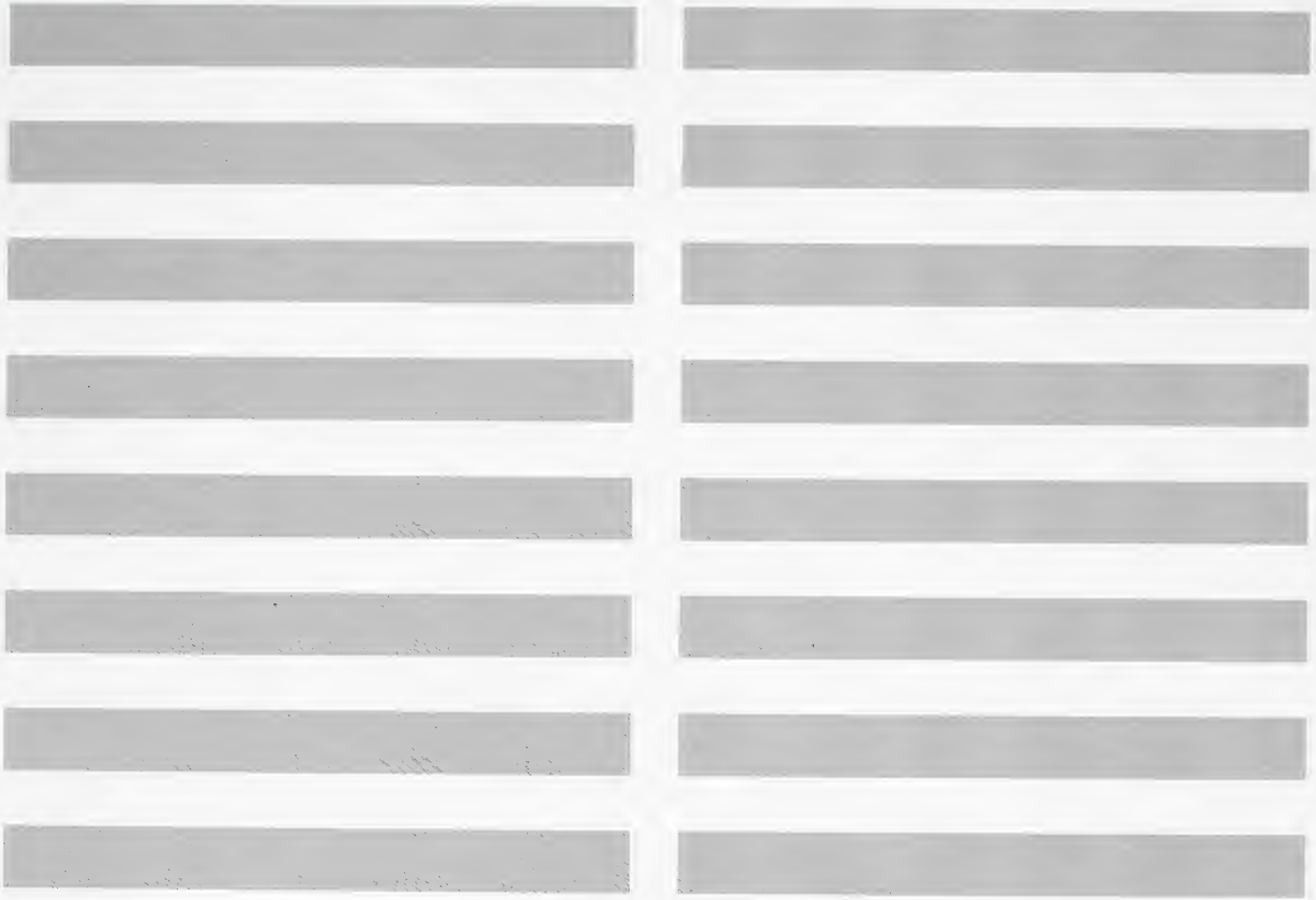


Counters

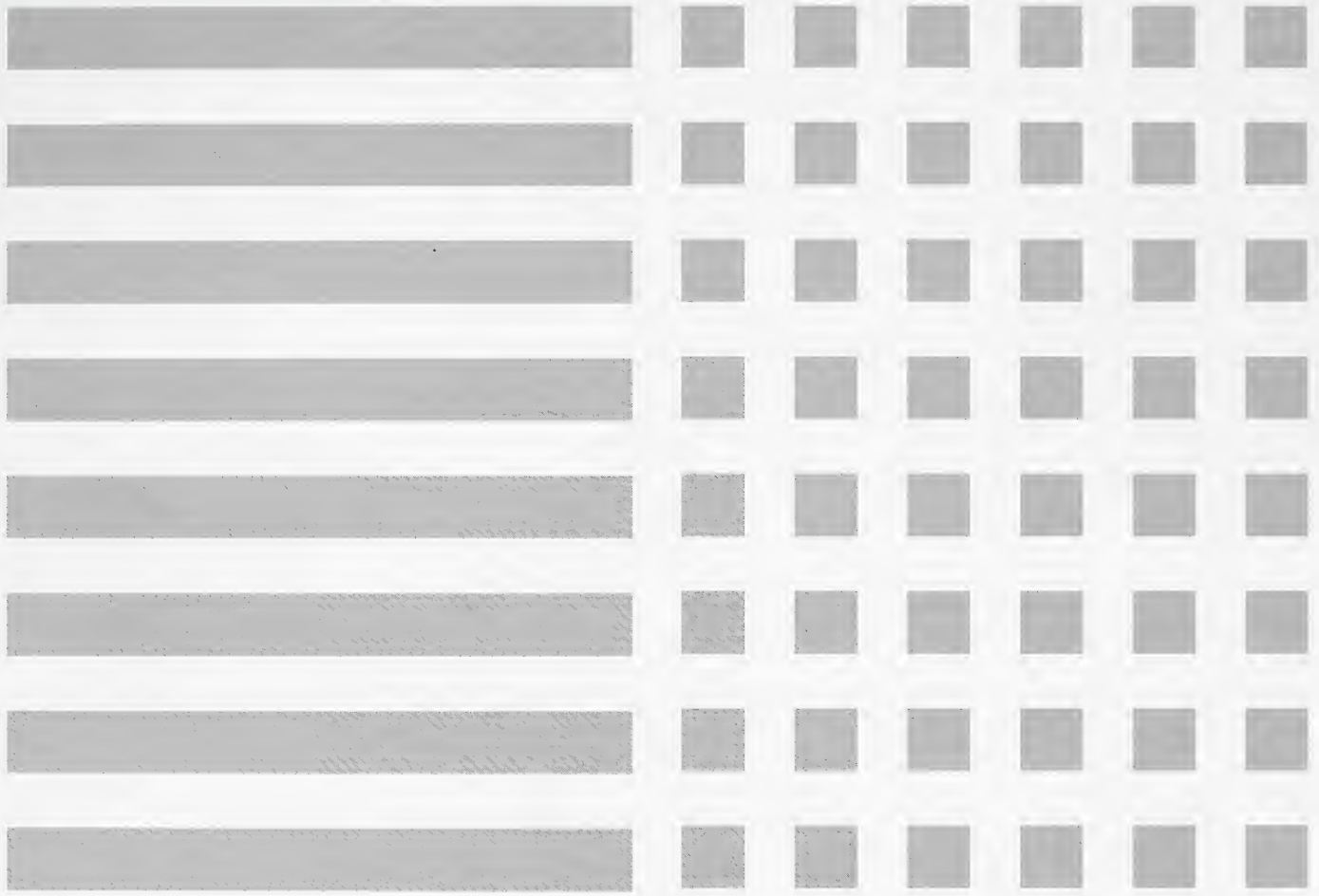


Base Ten Blocks, Set 1

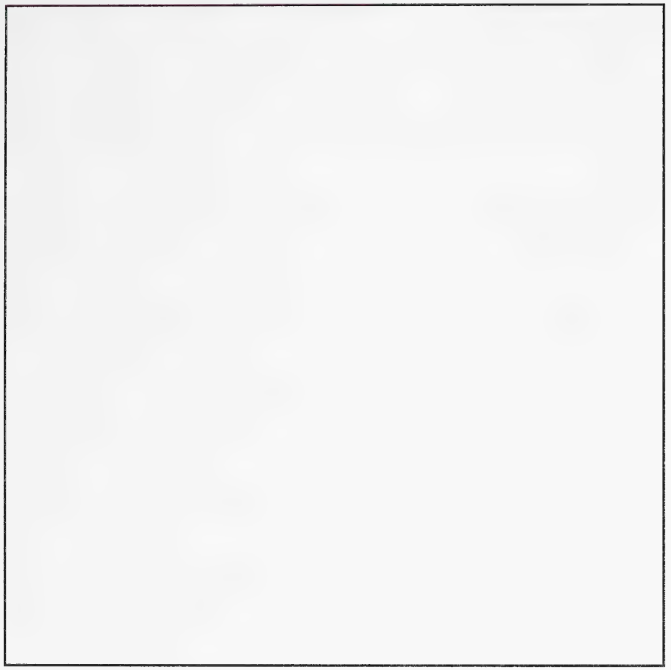
Base Ten Blocks, Set 1 (Continued)

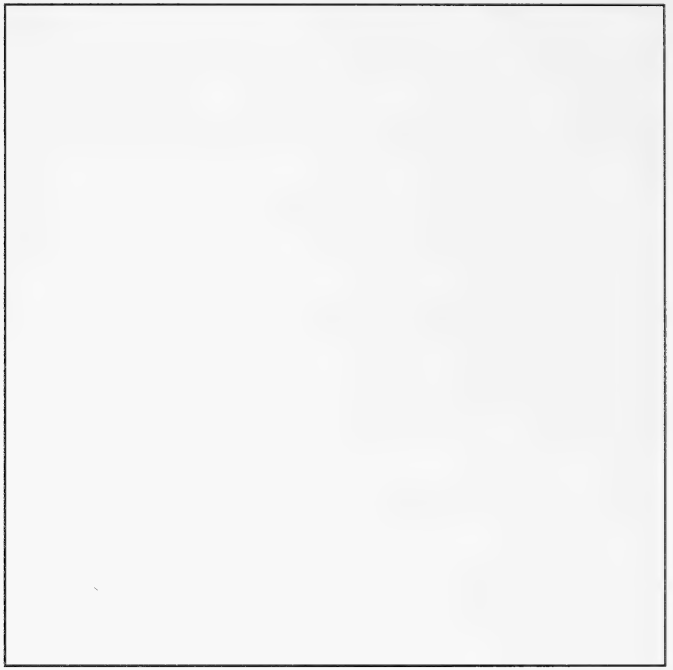


Base Ten Blocks, Set 1 (Continued)



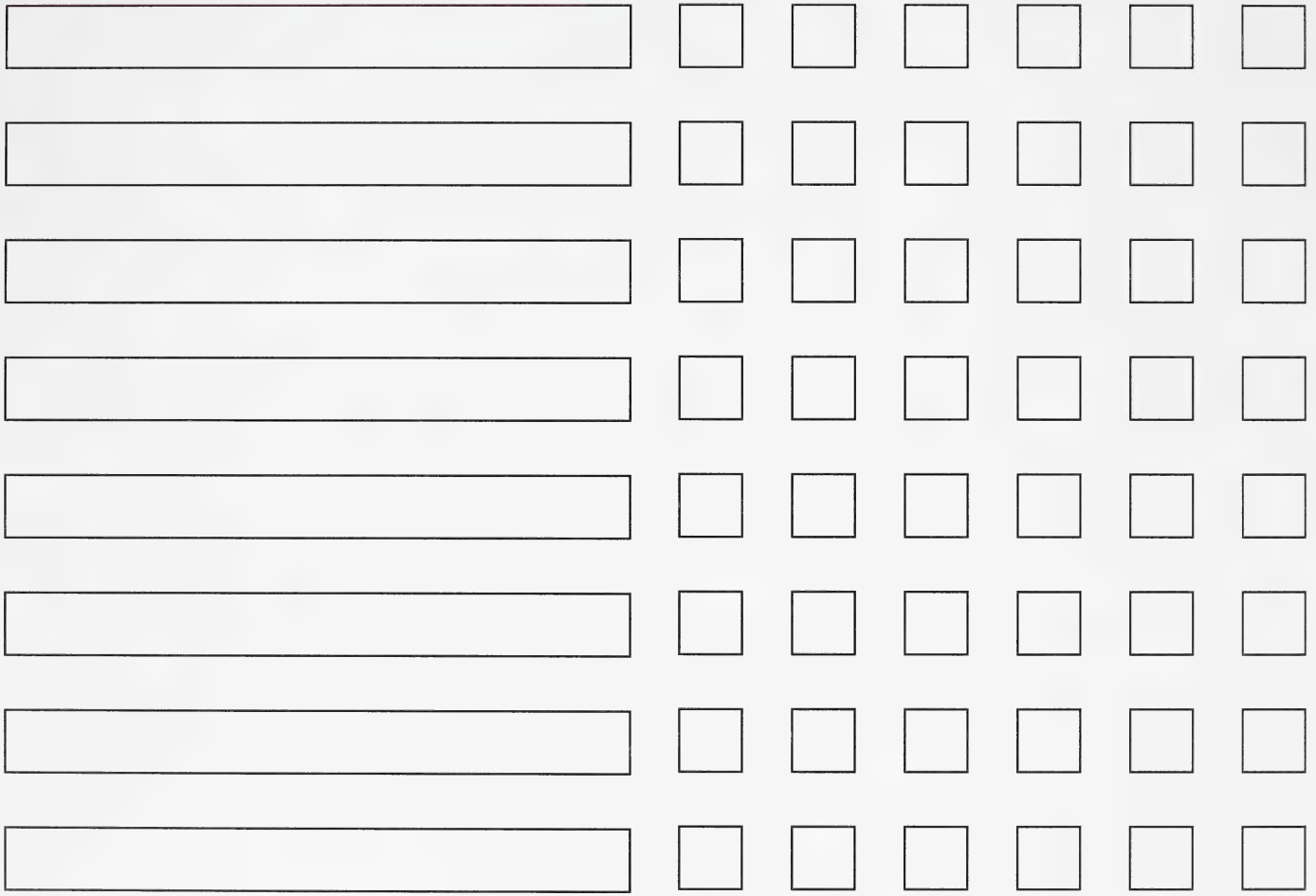
Base Ten Blocks, Set 2





Base Ten Blocks, Set 2 (Continued)

Base Ten Blocks, Set 2 (Continued)



Student and teacher: Use this cover sheet for mailing or faxing.

ASSIGNMENT BOOKLET

8110 Mathematics 8
Module 1

FOR STUDENT USE ONLY

Date Module Submitted:

_____

Time Spent on Module:

_____

(If label is missing or incorrect)

File Number:

_____

Module Number: _____

FOR TEACHER USE ONLY

Assigned Teacher: _____

Module Grading: _____

Graded by: _____

Date Module Received:

_____

Module Assignment Recorded: _____

Student's Questions and Comments

Apply Module Label Here

Name

Address

Postal Code

Please verify that preprinted label is for correct course and module.

Teacher's Comments

_____

Teacher

These instructions are for students registered with the Alberta Distance Learning Centre.

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When you are registered for distance learning courses, you are expected to submit Assignment Booklets for correction regularly. Try to submit each Assignment Booklet as soon as you have completed it. Do not submit more than one Assignment Booklet in one subject at the same time. Before submitting your Assignment Booklet, please check the following:

- Are all the assignments completed? If not, explain why.
- Has your work been reread to ensure accuracy in spelling and details?
- Is the booklet cover filled out and the correct module label attached?

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Do **not** enclose letters with Assignment Booklets.

Send all letters in a separate envelope.

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MATHEMATICS 8
MODULE 1

Number Connections

ASSIGNMENT BOOKLET

Distance Learning

Alberta EDUCATION

FOR TEACHER'S USE ONLY

Summary

	Total Possible Marks	Your Mark
Section 1 Assignment	42	
Section 2 Assignment	26	
Final Module Assignment	32	
	100	

Teacher's Comments

This document is intended for	
Students	✓
Teachers	✓
Administrators	
Parents	
General Public	
Other	

Mathematics 8
Assignment Booklet
Module 1
Number Connections
Learning Technologies Branch
ISBN 0-7741-1321-9

ASSIGNMENT BOOKLET
MATHEMATICS 8 – MODULE 1: NUMBER CONNECTIONS

Your mark on this module will be determined by how well you do your assignments in this booklet.

Work slowly and carefully. If you are having difficulties, go back and review the appropriate section.

There are three assignments in this Assignment Booklet. The total value of these assignments is 100 marks. The value of each assignment is stated in the left margin.

You may do your rough work on your own paper.

Be sure to proofread each assignment carefully.

(42)

Section 1 Assignment: Fractions

Read all the parts of your assignment carefully and record your answers in the appropriate place. When answering the following questions, be sure to clearly show how you arrived at your answers.

(2)

1. Which sum requires regrouping? Circle the letter of the best answer.

A. $1\frac{1}{2}+2\frac{1}{4}$

B. $3\frac{2}{5}+5\frac{1}{5}$

C. $4\frac{3}{8}+1\frac{1}{2}$

D. $2\frac{2}{3}+1\frac{2}{5}$

(2) **2.** Andrew read $\frac{1}{8}$ of a book on Monday and $\frac{3}{8}$ of the book on Wednesday. What fraction of the book did he read in these two days? Use this problem to complete 2.a. and 2.b.

a. Complete the following calculation using a paper-and-pencil method. Then give a statement answer to the problem.

$$\frac{1}{8}+\frac{3}{8}=$$

---

(2) **b.** Use diagrams or number lines to explain the sum.

3. Hussein opened two cartons of milk. One carton was $\frac{2}{3}$ full. Another carton was $\frac{1}{2}$ full. How much milk did Hussein have altogether? Use this problem to complete 3.a. and 3.b.

(2) **a.** Complete the following calculation using a paper-and-pencil method. Then give a statement answer to the problem.

$$\frac{2}{3}+\frac{1}{2}=$$

(2) **b.** Use diagrams or number lines to explain the sum.

4. Joan picked $\frac{2}{5}$ of a basket of apples. Robin picked $\frac{4}{5}$ of a basket. How much more did Robin pick than Joan? Use this problem to complete 4.a. and 4.b.

(2) **a.** Complete the following calculation using a paper-and-pencil method. Then give a statement answer to the problem.

$$\frac{4}{5} - \frac{2}{5} =$$

(2) **b.** Use diagrams or number lines to explain the difference.

5. Mark took $\frac{3}{4}$ h to do the dishes. Hans took $\frac{1}{2}$ h to vacuum. How much longer did Mark spend on his chores than Hans? Use this problem to complete 5.a. and 5.b.

(2) **a.** Complete the following calculation using a paper-and-pencil method. Then give a statement answer to the problem.

$$\frac{3}{4} - \frac{1}{2} =$$

(2) **b.** Use diagrams or number lines to explain the difference.

6. A recipe calls for $\frac{3}{4}$ of a medium banana. How much banana would be needed to make $\frac{1}{2}$ of the recipe? Use this problem to complete 6.a. and 6.b.

(2) **a.** Complete the following calculation using a paper-and-pencil method. Then give a statement answer to the problem.

$$\frac{1}{2} \times \frac{3}{4} =$$

(2) **b.** Use diagrams or number lines to explain the product.

7. Leonard is repackaging 4 crates of oranges into bags. Each bag holds $\frac{1}{3}$ of a crate. How many bags of oranges will Leonard have? Use this problem to complete 7.a. and 7.b.

(2) **a.** Complete the following calculation using a paper-and-pencil method. Then give a statement answer to the problem.

$4 \div \frac{1}{3} =$

---

(2) **b.** Use diagrams or number lines to explain the quotient.

8. Reggie ate $2\frac{1}{4}$ chocolate bars. Hank ate $1\frac{1}{2}$ chocolate bars. How many more chocolate bars did Reggie eat than Hank? Use this problem to complete 8.a. and 8.b.

(2) **a.** Complete the following calculation using a paper-and-pencil method. Then give a statement answer to the problem.

$$2\frac{1}{4} - 1\frac{1}{2} =$$

(2) **b.** Explain how you can use estimation to confirm that the answer in 8.a. is reasonable.

9. Kerstin biked for $2\frac{3}{4}$ h. Then she swam for $1\frac{1}{2}$ h. How long did she spend altogether on these two activities? Use this problem to complete 9.a. and 9.b.

(2) **a.** Complete the following calculation using a paper-and-pencil method. Then give a statement answer to the problem.

$$2\frac{3}{4}+1\frac{1}{2}=$$

(2) **b.** Explain how you can use estimation to confirm that the answer to 9.a. is reasonable.

10. Carson spends $\frac{3}{4}$ h each day reading the newspaper. In 20 days how much time does he spend reading the newspaper? Use this problem to complete 10.a. and 10.b.

(2) **a.** Complete the following calculation using a paper-and-pencil method. Then give a statement answer to the problem.

$$\frac{3}{4} \times 20 =$$

(2) **b.** Explain how you can evaluate the expression $\frac{3}{4} \times 20$ using a calculator with a fraction key.

11. A group had a car wash to raise money for a camp out. The group washed 5 cars in $1\frac{1}{4}$ h. On average, how long did the group spend washing each car? Use this problem to answer 11.a. and 11.b.

(2) **a.** Complete the following calculation using a paper-and-pencil method. Then give a statement answer to the problem.

$$1\frac{1}{4} \div 5 =$$

---

(2) **b.** Explain how you can use estimation to confirm that the answer to 11.a. is reasonable.

26

Section 2 Assignment: Positive and Negative Numbers

Read all the parts of your assignment carefully and record your answers in the appropriate place. When answering the following questions, be sure to clearly show how you arrived at your answers.

1. Make a diagram to show how you could represent each of the following numbers using base ten blocks.

(1) **a.** + 1.43

(1) **b.** −2.05

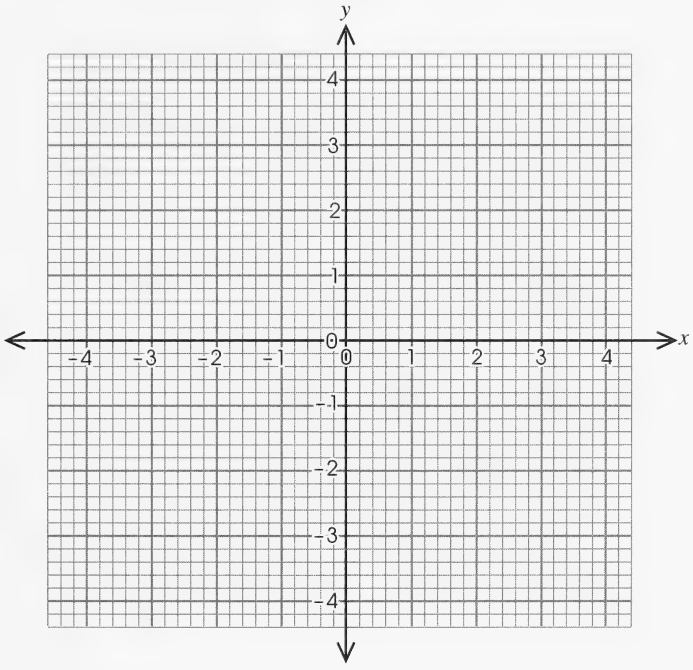
(2) **2.** Show each of the following numbers on the given number line. Label the dots.

- −1.2
- −2.6

(2) **3.** Explain why -0.43 is less than -0.34.

(2) **4.** Plot each of the following ordered pairs on the given graph. Label the ordered pairs.

- $(-2.4,\ +1.8)$
- $(+3.6,\ -2.4)$



(2) **5.** In this module you discovered several ways to explain why the product of two negative numbers equals a positive number.

- You modelled the operations with counters and base ten blocks.
- You used patterns.
- You used "yeah-boo" stories.

Which of these methods do you think explains why the product of two negative numbers equals a positive number? Why?

6. A mutual fund closed down \$0.25 on Tuesday and up \$0.13 on Wednesday. What was the change in value after the two days?

(2) **a.** Complete the following calculation using a paper-and-pencil method. Give a statement answer to the problem.

$(-0.25)+(+0.13)=$

(2) **b.** Use diagrams to explain the sum.

7. The temperature was $-1.3°\,C$ when Freddie awoke in the morning. The temperature was $1.5°\,C$ at noon. What change in temperature did Freddie experience from morning to noon?

(2) **a.** Complete the following calculation using a paper-and-pencil method. Give a statement answer to the problem.

$(+1.5)-(-1.3)=$

---

(2) **b.** Use diagrams to explain the difference.

8. The outside temperature was $-13.5°\text{C}$. The wind made the air feel 2.5 times colder. What was the windchill equivalent temperature?

(2) **a.** Complete the following calculation using a paper-and-pencil method. Give a statement answer to the problem.

$(+2.5)\times(-13.5)=$

(2) **b.** Explain how you can use estimation to confirm the answer in 8.a. is reasonable.

9. The temperature dropped $4.9°\text{C}$ in 3.5 h. What was the average change in temperature per hour? Use this problem to complete 9.a. and 9.b.

(2) **a.** Complete the following calculation using a paper-and-pencil method. Give a statement answer to the problem.

$(-4.9)\div(+3.5)=$

(2) **b.** Explain how you can use a calculator with a sign-change key to evaluate the expression $(-4.9) \div (+3.5)$.

(32)

Final Module Assignment

Read all the parts of your assignment carefully and record your answers in the appropriate place. When answering the following questions, be sure to clearly show how you arrived at your answers.

1. Dale has $\frac{5}{6}$ of a bale of hay.

(4) **a.** If Dale gives his horse $\frac{1}{4}$ of this hay, what fraction of a bale did his horse receive?

(4) **b.** If Dale gives his horse $\frac{1}{4}$ of a bale each day, how long will the hay last?

(4)

c. If Dale gives his horse $\frac{1}{4}$ of a bale, what fraction of the whole bale does he have left?

(4)

2. Thierry picked $\frac{5}{6}$ of a basket of berries in one row and $\frac{1}{4}$ of a basket of berries in a second row. How much did he pick in the two rows?

(4)

3. Amanda is jogging west along an east-west road at a speed of 2.8 m/s. What was her location 4 s ago from her present position?

(4) **4.** The temperature in Calgary is $2.8°C$. The temperature in Red Deer is colder by $4.0°C$. What is the temperature in Red Deer?

(4) **5.** The price of a stock dropped $2.80 over a four-day period. On average, what was the change per day?

(4) **6.** Allison withdrew $4.00 from her piggy bank. If the balance in her bank was $2.80 afterwards, how much was there in the piggy bank before the withdrawal?

ASSIGNMENT BOOKLET DECLARATIONS

The Student's Declaration is to be filled in by a student registered at the Alberta Distance Learning Centre. If the student is under 16, the Learning Facilitator's Declaration is to be filled in by the learning facilitator. Failure to complete this page may invalidate the assignment results.

STUDENT'S DECLARATION

- I have followed the instructions outlined in the Student Module Booklet.
- I have completed the activities to prepare myself for the assignments in this Assignment Booklet.
- I completed the assignments in this Assignment Booklet by myself.

_____

Student's Signature

LEARNING FACILITATOR'S DECLARATION

I hereby certify that I have supervised the learning activities completed by _____.

Student's Name

I also certify that to the best of my knowledge the assignments in this Assignment Booklet were completed independently by this student.

_____

Supervisor's Signature

If you, the student or learning facilitator, have any comments or observations regarding this module, write them in the following space.

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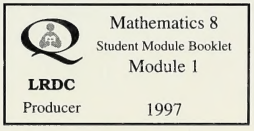
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